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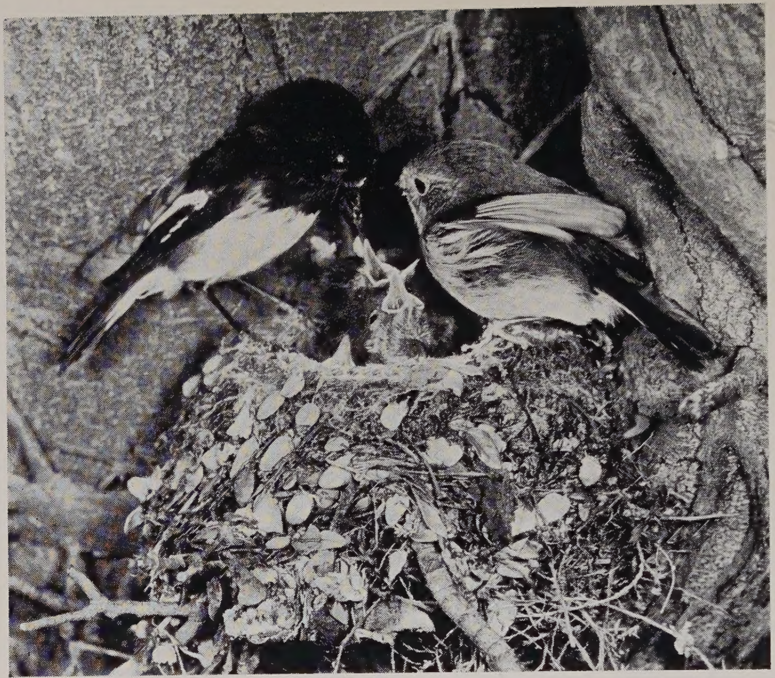

Lake Ohau *K. V. Bigwood*

YELLOW-BREASTED TOMTIT
Male and Female

NEW ZEALAND BIRDS

BY

W. R. B. OLIVER

D.Sc., F.R.S.N.Z., Hutton and Hector Medallist
Director, Dominion Museum, Wellington, 1928-47,
and Canterbury Museum, Christchurch, 1947-48

SECOND EDITION
Revised and Enlarged

WELLINGTON
A. H. & A. W. REED

LINCOLN PARK ZOO

First edition 1930
Second edition 1955

A. H. & A. W. REED
Publishers of New Zealand Books
182 Wakefield Street
Wellington

598.29
.93
O48
1955

Printed and bound by
Hutcheson, Bowman & Stewart Ltd., Wellington

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Kingfisher	*K. V. Bigwood*
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Gannets at Cape Kidnappers	*R. V. Francis Smith*
Pied Stilts	*K. V. Bigwood*
Crested Grebe	*R. V. Francis Smith*
Chatham Island Royal Albatross	*W. H. Knox*

The colour transparencies by K. V. Bigwood are used
by courtesy of National Publicity Studios, Wellington

PREFACE

The present book is intended to be a handy reference work on the birds of New Zealand. It does not pretend to be an exhaustive account but merely a summary of what is known about our birds—recent, fossil and naturalized—with keys to their identification, also the chief references in literature in order to enable the student further to follow up the subject. The author's object will have been achieved if, by the publication of this book, interest in New Zealand's unique avifauna is increased, for it is thought that by the diffusion of knowledge of our birds their value will be better appreciated and their preservation for the future made more certain.

The information has been so selected that the book should be useful not only to the professed ornithologist, but also to all interested in wild life, including the tourist and tramper; to those whose business and pleasure pursuits call them away from the towns; and to the overseas visitor who wishes to carry away with him some souvenir that will remind him of the fascinating natural productions of the country.

For the systematic portion of the work practically all the descriptions have been drawn up from specimens and in a uniform manner. In a few instances no specimens were available in New Zealand. The classification has been revised wherever I thought the relationships of the species would better be expressed by so doing. For the moas I have followed the classification in my book, *The Moas of New Zealand and Australia*, published by the Dominion Museum. The descriptions here given should enable anyone, who will take the trouble to make a few measurements, to identify the bones of moas. A considerable amount of information and many of the illustrations are published for the first time, while the drawings of birds' heads have been specially prepared for the first and the present editions.

A few explanations only are necessary to enable the student to use the book to full advantage. The metric system of measurement is used throughout, all dimensions of the birds and their eggs being given in millimetres. To reduce millimetres to inches divide by 25.4. The scale given below shows inches and millimetres. The bill measurement means the "chord of the culmen," from the tip to the base; the wing is measured from the carpel flexure to the tip; the tail from the base of the rectrices (tail feathers) to the tip; and the tarsus means the length of the metatarsus. The references are shown in their shortest form, namely, abbreviated titles followed by figures representing the volume, page and date of publication, in that order. If two figures are given, they represent the page and date.

The first edition of this book of 2,000 copies, published in 1930, having been sold out several years ago, I decided to undertake a revision. It was not long after I began, about five years ago, that I realised that so much new information about our birds had been published since the first edition was issued that it practically meant rewriting the book. The first edition, however, forms the basis and little has been altered in the descriptions of the species. In the remaining sections of the work there are extensive additions and revisions. Emphasis has been laid on ecology where the relationship of the species to other animals and to plants is discussed. Often this concerns the impact of introduced mammals, including man, on our birds. In the first edition the species was made the unit for treating the birds. In the present edition it is the subspecies, more particularly those related forms occupying different geographical areas. In other words many species as formerly recognised are now listed as geographical races or subspecies of "polytypic" species. Consequently merely to count the number of species as accepted today would hardly give a correct idea of the number of kinds of birds in the country. The question of taxonomy is discussed in the chapter on species and subspecies, where I give reasons for not following in their entirety the proposals for lumping together as subspecies a number hitherto accepted as good species and which differ from each other in important characters.

As a contribution towards the stabilizing of scientific names a definition of a species is proposed. The journal of the Ornithological Society of New Zealand, *Notornis,* has been an invaluable source of information on distribution within New Zealand and for records of additions to the avifauna.

The number of species and subspecies of recent indigenous New Zealand birds described in this book is 308, grouped in 251 species. Of these species 161 breed in the New Zealand region and 90 are visitors. Some of those included as recent species are now extinct but they were living at the time Europeans settled in the country and their appearance is known. Fifteen species and subspecies are sight records only. In addition there are 56 species of fossil birds, of which 28 are moas, known only by their bones. There are also 37 species of exotic birds naturalized in New Zealand.

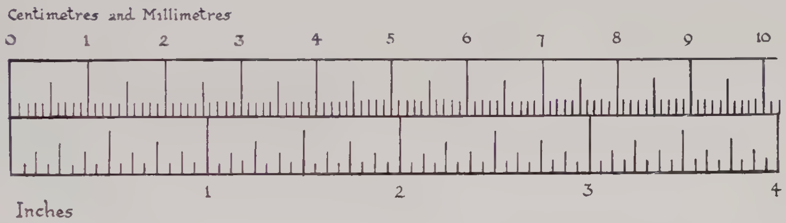
The following new names published in the first edition have stood the test of time: Family *Anomalopterygidae;* Subfamily *Pachyptilinae*; Genera *Pachydyptes, Euryanas*; Species Pachydyptes *ponderosus*, P. *novae zealandiae*; Subspecies Cyanoramphus novaezealandiae *chathamensis,* Bowdleria punctata *stewartiana.* The genera, species and subspecies described for the first time in the present edition are (new names in italics) Pachyptila turtur *subantarctica,* Coenocorypha aucklandica *barrierensis, Pachyanas chathamica,* Cygnus *chathamicus,* Cereopsis *novaezealandiae, Pyramida* hodgeri, Cnemiornis *septentrionalis.*

It remains now to express acknowledgements and thanks to those who have assisted with the work. It would be impossible for anyone alone to produce a book of the nature of the present one without help from numerous friends. In the present case I have received valuable assistance in the way of information or illustrations wherever I have applied. What I trust will be considered a valuable feature of this book are the illustrations. I have been fortunate in being able to obtain a selection of photographs fairly representative of the work that has been done in bird photography in New Zealand during the past forty years. From almost all to whom I applied I received generous responses with the result that appears in this book. The sources of the photographs are duly acknowledged throughout the book, but I would here like to express my sincere thanks to the following who supplied me with considerable series of studies of living birds: K. V. Bigwood, J. H. Sorensen, A. S. Wilkinson, C. A. Fleming, L. E. Richdale, W. P. Mead, G. M. Turner, E. G. Turbott. For a series of photographs taken by the late Mr. E. F. Stead I am indebted to the Director of the Canterbury Museum, and for a series taken by the late Mr. H. Guthrie-Smith I am indebted to the Director of the Dominion Museum. For the use of blocks of the photographs taken by the late Major G. A. Buddle I have to thank the publishers, Messrs. A. H. and A. W. Reed. For permission to use photographs procured from the National Publicity Studios I wish to thank the General Manager of the Tourist and Publicity Department. The Directors of the Auckland, Wanganui, Dominion, Canterbury, Otago and Southland Museums have generously allowed me to examine the collections of bird skins under their charge. Lastly I would like to thank Mr. E. G. Turbott of the Auckland Museum, Mr. C. McCann of the Dominion Museum and Mr. R. J. Scarlett of the Canterbury Museum for their very helpful assistance when examining the specimens under their charge. Many of the localities recorded for the fossil birds have been supplied by Mr. Scarlett.

The drawings of birds' heads brought forward from the first edition are by the late Miss Lily Daff, the late Mr. E. H. Atkinson, and Mr. B. Osborne. The number in the present work is more than double that in the first edition. For these additional ones my thanks are due to Mrs. R. H. D. Stidolph, Miss M. Morison, Miss L. D. Buswell, Mr. C. McCann and Mr. R. Jacobs. The proofs have been read by Mr. R. H. D. Stidolph and Mr. A. S. Wilkinson and parts of the manuscript on penguins and petrels by Dr. L. E. Richdale. I wish to record my sincere thanks to these ornithologists who suggested various alterations and improvements.

W. R. B. OLIVER.

Seatoun, New Zealand.



HISTORY OF ORNITHOLOGICAL DISCOVERY IN NEW ZEALAND

The first of the celebrated voyages of Captain James Cook round the world was despatched by the British Government for the purpose of observing the transit of Venus. The president of the Royal Society at that time was Sir Joseph Banks, a gentleman whose chief claim to fame rests not so much on his own personal investigations or publications as on the great encouragment and financial assistance he gave to others. Realising the wonderful opportunity for scientific discovery that presented itself in the projected expedition to the South Seas, Banks obtained permission to accompany Cook in the *Endeavour*. He provided all the equipment necessary at his own expense and took with him Dr. Daniel Charles Solander, two artists, one of whom was Mr. Sydney Parkinson, and two other assistants.

The *Endeavour* left Plymouth on August 25th, 1768, and after rounding Cape Horn proceeded to Tahiti. About four months were spent in the Society Group and the course was then set south-westward into unknown seas. On October 6th, 1769, land was sighted and on the 8th the *Endeavour* anchored in an inlet to which Cook afterwards gave the name of Poverty Bay. A landing was made the same day but the party was attacked by Maoris, one of whom was killed. An encounter on the following day resulted in more Maoris being killed. The landing on the third day was more successful, but the Maoris again became troublesome so Cook decided to leave the locality. The next landings were made at Anaura Bay where some birds were shot and at Tolaga Bay, where, according to Cook, the woods abounded with a great variety of beautiful birds. At Mercury Bay some shags were shot and eaten and the voyage was then continued to the Thames River and the Bay of Islands. Off the Three Kings gannets were taken and, like the shags, were consigned to the pot. Queen Charlotte Sound was reached on January 16th, 1770, and during a stay of three weeks collections of plants and birds were made. Cook next sailed completely round the South Island before proceeding to Australia. With the exception of an albino pukeko, no specimens of the birds collected in New Zealand during Cook's first voyage are now extant. The method of preserving them seems to have been merely salting the skins or even the bodies with their skins on. Solander made careful descriptions of the species but his manuscript was never published and that portion of it now preserved in the British Museum contains accounts of only twelve petrels, the gannet and the skua.

The first important contribution to the ornithology of New Zealand was made as a result of Cook's second visit. The *Resolution* and *Adventure* left England on April 9th, 1772, with John Reinhold Forster and his son George Forster on board the *Resolution* in the capacity of naturalists. At the Cape of Good Hope Dr. A. Sparrman, a former pupil of Linne, joined the expedition. A stay was made at Dusky Sound from March 26th to May 1st, 1773. Here a fairly extensive collection of birds was made of which detailed descriptions were drawn up by J. R. Forster and sketches made by his son. Cook next proceeded to Queen Charlotte Sound, remaining there from May 18th to June 7th. The investigations of the Forsters on birds and plants were continued, and many more birds collected and sketches made. After cruising to the south-eastward of New Zealand in search of a southern continent Cook returned to Queen Charlotte Sound remaining there from the 3rd to the 25th of November. Another year's exploration in the Pacific took place and Cook once more returned to Queen Charlotte Sound where he stayed from October 19th to November 10th, 1774, when he left on the return voyage to England.

Altogether during Cook's second voyage the Forsters collected 38 species of birds in the New Zealand region and of these George Forster made drawings of 35 species. Both the specimens and drawings, together with those specimens collected during Cook's first voyage were used by Latham when writing his *General Synopsis of Birds,* an extensive work in which the Linnean system of nomenclature was not adopted. From the labours of Latham, J. F. Gmelin reaped a rich harvest by merely condensing the English descriptions of Latham into Latin diagnoses and bestowing on them binomial names. Hence Gmelin appears as the authority for many of the names of New Zealand birds collected by the Forsters. J. R. Forster's own account of the birds of Cook's second voyage was not published until long after his death. It was edited by Lichtenstein and issued in Latin in 1844 under the title *Descriptiones Animalium.*

Cook left England on his third voyage on July 12th, 1776, and stayed at Queen Charlotte Sound from February 12th to 25th, 1777. During this time the surgeon, W. Anderson, made some observations on the birds, mentioning altogether 26 species, most of which are recognisable, and W. W. Ellis made seven drawings.

For nearly fifty years following Cook's last visit to Queen Charlotte Sound little was done in ornithological discovery in New Zealand although this period included one of the most important discoveries of bird life in New Zealand, namely, the capture of a kiwi in Dusky Sound in 1812. In 1824 the French surveying corvette *Coquille,* under the command of Captain Duperrey, arrived at the Bay of Islands and remained for nearly a fortnight. R. P. Lesson was on board as naturalist while Dumont d'Urville, one of the ship's officers, was also an ardent collector. Lesson's discoveries include the North Island robin and tomtit.

In 1827 d'Urville revisited New Zealand in command of the same ship renamed the *Astrolabe.* Lesson again accompanied him and also J. R. C. Quoy and P. Gaimard as zoologists. About two months were spent in New Zealand, the localities visited being Tasman Bay, French Pass, Tolaga Bay, Whangarei Heads, Waitemata Harbour and the Bay of Islands. In the report of the zoology of the voyage, the joint work of Quoy and Gaimard, twelve species of New Zealand birds are described. Those new to science include the grey warbler, quail, wrybill plover and fernbird.

During the years 1839, 1840 and 1841 three exploring expeditions, a French, an American and a British, visited New Zealand. The French expedition in the ships *Astrolabe* and *Zelee,* under the command of Admiral d'Urville, procured the first specimens of the bronze shag to be collected. Three vessels of the American Exploring Expedition under the command of Captain Charles Wilkes called at the Bay of Islands in 1840. Titian Peale, the ornithologist to the expedition, described twelve species of birds from this locality, including the little black shag, not seen again in New Zealand by an ornithologist for over fifty years. Peale's report on the birds of the expedition appeared in 1848, but shortly afterwards most of the stock was destroyed by fire so that the work is now excessively rare.

The British expedition in the *Erebus* and *Terror,* after an Antarctic cruise including a visit to the Auckland and Campbell Islands, arrived at the Bay of Islands in August, 1841, remaining there over three months. Sir James Clark Ross was in charge of the expedition while the surgeons Joseph Dalton Hooker and Robert M'Cormick acted as naturalists. The birds procured on this expedition, together with all others from New Zealand in the British Museum, were used by George Robert Gray when writing the first descriptive account of all the birds of New Zealand known at that time. In Gray's account, which was published in 1845 in the report on the zoology of the expedition, 99 species were admitted and of these 26 were illustrated in colour.

Among those who collected birds in New Zealand about this time should be mentioned

Percy Earl and Miss Stone who forwarded many specimens to the British Museum.

Dr. Ernest Dieffenbach arrived in New Zealand in 1839 and made several journeys to unexplored portions of the country, including Mount Egmont, Taupo, Kapiti, the Chatham Islands and Queen Charlotte Sound. In his work *Travels in New Zealand* he gives some account of the birds and in the appendix Gray gives a complete list of the birds, 84 species are admitted, the first to be published (1843).

From 1847 to 1851 Captain Stokes in the *Acheron* was engaged in a survey of the New Zealand coast. Dr. Lyall was surgeon and naturalist and collected a number of birds especially in the south-west of the South Island.

We now come to the period of intensive study of the avifauna of New Zealand by the resident ornithologists. First comes Thomas Henry Potts, one of the truest naturalists New Zealand has had the good fortune to possess. Potts arrived in New Zealand in 1853 and settled in Canterbury. He made extensive journeys in the mountain districts of Canterbury and Westland and in Banks Peninsula, patiently observing the minutest details of the habits of wild birds, paying especial attention to their nesting habits. He was fortunate in carrying out his investigations at a time when the birds had suffered little from the advance of settlement; species now rare or extinct were then quite common. He published a series of papers in the early volumes of the *Transactions of the New Zealand Institute*, the same material being later issued in book form in 1882 in a little volume entitled *Out in the Open*. Among the new species described by Potts were the roa or great grey kiwi, and the black-billed gull.

Walter Lawry Buller was born at Tangiteroria in 1838. From early boyhood he showed a natural taste for scientific objects, but was especially interested in ornithology. His first published paper, *An Essay on the Ornithology of New Zealand*, gained him a silver medal from the Royal Commissioners of the New Zealand Exhibition of 1865, and during the next forty years he never ceased to collect and observe the birds of New Zealand. During this period he published on birds, besides 74 papers in the *Transactions*, the following works: *History of the Birds of New Zealand*, 1873, a full descriptive account illustrated with coloured plates; *Manual of the Birds of New Zealand*, 1882; *History of the Birds of New Zealand, Second Edition*, 1888, in two volumes with coloured plates; *Supplement to a History of the Birds of New Zealand*, 1905, in two volumes, with coloured plates. These monumental publications are the result of an enormous amount of research and labour and will ever remain the standard works of reference on the birds of New Zealand. Buller's great achievement was to bring the study of New Zealand ornithology from the scattered reports of visiting expeditions to a complete systematic account with full descriptions, history and habits of all the species then known, Buller contributing from his own observations no small share of this knowledge. Buller received the highest honours from many countries including Fellowship of the Royal Society in 1876, and a knighthood (K.C.M.G.) in 1886.

A considerable amount of information regarding the birds of New Zealand was added by three geologists during their exploration work.

Julius von Haast arrived at Auckland in 1858 and later became Curator of the Canterbury Museum. While investigating the structure of the Southern Alps he discovered the rock wren. The day after Haast arrived in Auckland the Austrian frigate *Novara* entered the harbour. The geologist to the expedition was Dr. H. von Hochstetter who remained in New Zealand for several months and was accompanied in his geological expeditions by Haast. In Pelzeln's report of the birds of the *Novara* expedition about 27 species are recorded from New Zealand.

A great influence was exerted on science in New Zealand by Dr. (afterwards Sir James) Hector who arrived in the country in 1861. Hector immediately began exploration work in the South West of Otago, visiting the same district as the Forsters had collected in during Cook's second voyage. Although primarily a geologist, Hector did not fail to observe the bird life and collect specimens. He discovered the South Island kiwi in considerable numbers at a time when only a few specimens had been obtained.

Captain Frederick Wolaston Hutton, who arrived in New Zealand in 1866, was both a geologist and a zoologist and made important contributions to both subjects. His first published papers on New Zealand birds were lists of the species found in the Great and Little Barrier Islands and in the Province of Auckland. In 1871 he issued a descriptive catalogue of the birds of New Zealand, the first separate book on the subject that appeared. He contributed a number of papers to the *Transactions* on bird flight, migration, geographical distribution and taxonomy, and in 1904 issued as joint author with Mr. James Drummond a popular account of the birds of New Zealand in a volume entitled *The Animals of New Zealand.*

The Austrian collector Andreas Reischek arrived in New Zealand in 1877 and spent more than twelve years in the country making extensive collections of birds for European museums. Besides being a collector Reischek was a keen observer and contributed a number of valuable papers to the *Transactions.* He spent several months each on the Chickens, Little Barrier Island and at the West Coast Sounds, sometimes undergoing severe hardships, and he also visited the Southern Islands.

The German ornithologist Dr. Otto Finsch interested himself in New Zealand birds and began the preparation of a book on the subject. He contributed numerous critical and descriptive notes to the *Journal fur Ornithologie* based on specimens forwarded by Haast and Hector. Finsch visited New Zealand in 1882.

The flesh-eating propensities of the kea were the subject of inquiries by Professor W. B. Benham, Mr. G. R. Marriner and Dr. J. G. Myers. Marriner made special trips to the Canterbury Mountains in winter to observe the damage done by this bird and published a book on the subject—*The Kea: a New Zealand Problem.* (1907.)

The nomenclature of New Zealand birds received a rude adjustment at the hands of Messrs. Gregory M. Mathews and Tom Iredale, who laid a firm foundation in their paper published in the *Ibis,* 1913.

The intimate life history of New Zealand birds was very ably investigated by Messrs. H. Guthrie-Smith and J. C. M'Lean. M'Lean's work was carried out in Poverty Bay district and published in the *Emu* and *Ibis.* Guthrie-Smith has carried his work farther afield, and in the most inaccessible island haunts of the species and in other places has in an inimitable way recorded the domestic arrangements of many species, some exceedingly rare. Unlimited patience and considerable skill in the manipulation of his camera have enabled Guthrie-Smith to add greatly to the value of his observations. In extracting from nature its innermost secrets and portraying them in appropriate language and picture, no observer in New Zealand has equalled Guthrie-Smith. Guthrie-Smith's five published books are *Birds of the Water, Wood and Waste* (1910), *Mutton Birds and other Birds* (1914), *Tutira* (1921), *Bird Life on Island and Shore* (1925), *Sorrows and Joys of a New Zealand Naturalist* (1936).

Bird song has been assiduously studied by Mr. Johannes C. Andersen who, with whistle and note book, has attentively listened to the birds in the forest and fixed their calls in musical notation. His results are embodied in a series of papers in the *Transactions* and in a separate book, *Bird Song and New Zealand Song Birds* (1926).

Edgar Stead was one of the most experienced field ornithologists that ever worked in New Zealand. Unfortunately his notes have not been preserved and, besides some small papers, the only publication we have to remember him by is his book *Life Histories of New Zealand Birds,* 1932, containing accounts of eighteen species accompanied by reproductions of very excellent photographs. The book will ever remain a classic of New Zealand bird literature. Stead's extensive collection of bird skins and eggs and his negatives were bequeathed to the Canterbury Museum.

The ornithological work of Dr. R. A. Falla has been concerned especially with investigations into the life histories and taxonomy of petrels. In pursuit of his subject he made detailed observations on many island breeding places off the east coast of the Auckland Province. He visited the Three Kings group in 1934 and later carried out ornithological work in all the Southern Islands. In 1940 he published a revision of the difficult group of dove petrels.

On the subject of bird migrants from overseas Stead published a paper on waders adding new names to the list and recording the occurrences noted by him, while Falla dealt with Arctic migrants. A group of ornithologists stationed in Auckland and its vicinity has for several years regularly watched the movements of migratory birds in Manukau Harbour and the Firth of Thames. As a result some species have been added to the list of migrants visiting New Zealand and several papers have been published in *Notornis.* Concerning local bird migration valuable field observations are included in Guthrie-Smith's works, while a summary of the reports from some forty correspondents has been published by Mrs. Perrine Moncrieff.

Dr. C. A. Fleming has been very active in field work on New Zealand birds and has visited nearly all parts of the country as well as the outlying islands. As a result he has made some notable contributions to ornithological literature. Among them are the phylogeny of the prions, a review of the tits and robins, the birds of the Chatham Islands and, in collaboration with Dr. K. A. Wodzicki, a census of the gannet colonies in New Zealand.

Major G. A. Buddle studied and photographed birds in their natural haunts for many years. Besides papers on the spotless crake, the dabchick and others he published a magnificent series of photographs with accounts of the breeding habits of the species in a book entitled *Bird Secrets,* 1951. The author did not live to see his work in print. Many of Buddle's photographs were used by E. G. Turbott in his book *New Zealand Bird Life,* 1947.

New Zealand ornithologists and, indeed, many throughout the world, were electrified towards the end of 1948 by the announcement that Dr. G. B. Orbell had discovered a colony of takahes at an altitude of about 3,000 feet on the eastern end of the Murchison Range above Lake Te Anau. The Government immediately proclaimed a large area of the mountainous region on the western side of the lake a special reserve and has since regularly sent in parties to observe the birds.

In 1941 was founded the Ornithological Society of New Zealand, the first President being Dr. R. A. Falla. From small beginnings the society has grown to a membership of over 700 and publishes at quarterly intervals a journal under the title *Notornis.* The society has undoubtedly created a wide interest in New Zealand birds and has distributed much information through its journal.

Since 1934 when a scientific expedition visited the Three Kings Islands in the *Will Watch* several trips have been made to the group in private launches. In most cases these have carried members of the staff of the Auckland Museum and as a result a great deal of information on the plant and animal life of these islands has been published in the *Records of the Auckland Museum.* The report on the birds was written by E. G. Turbott, 1948.

Kapiti Island Bird Sanctuary has been fortunate in having as its curator for a period of eighteen years Mr. A. S. Wilkinson who, with Mrs. Wilkinson, studied the birds on the island and took many fine photographs. Wilkinson published an account of the birds in the *Emu* in 1927 and later, in collaboration with Mrs. Wilkinson, wrote a book on the history, zoology and botany of the island. The greater part of this work was devoted to birds. It was published in 1952 under the title *Kapiti Bird Sanctuary*.

On Otago Peninsula L. E. Richdale made long and detailed studies of the Chatham Island Royal Albatross and the Yellow-eyed Penguin. By a system of ringing he was able to trace the life histories of individual birds and to note the matrimonial complications that took place. Most attention was paid to behaviour patterns which were closely studied, named and defined.

The Sounds National Park in western Otago has not received the ornithological attention it deserves. Dusky Sound was the scene of the Forsters' first bird investigations in New Zealand, in 1773, and in this same sound forty years later was found the first kiwi that reached England. Here too on Resolution Island in 1849, was found the first takahe known to science. Richard Henry was caretaker of Resolution Island Bird Sanctuary in the last decade of the nineteenth century and he wrote some account of the birds in a Government pamphlet published in 1903. The lightkeeper at Puysegur Point, R. S. Sutherland, made and published some interesting information on crested penguins. An expedition to Caswell Sound, officially styled the New Zealand-American Fiordland Expedition, was organized by the New Zealand Government in 1949. A camp was established on the Stillwater River and from February to April was occupied by mainly Government personnel representing various branches of science. Also present were scientists from the United States investigating wapiti. Bird observers were K. A. Wodzicki, P. C. Bull, C. J. Lindsay and myself.

KERMADEC ISLANDS

Though a few specimens of birds were collected at Raoul Island by McGillivray on the occasion of the visit of H.M.S. *Herald* in 1854, the credit of making known the avifauna of the group is due to T. F. Cheeseman, curator of the Auckland Museum, who visited the Islands in the *Stella* in 1887 on a botanical quest. At the instigation of Cheeseman, Mr. T. Bell, the occupier of the island, forwarded collections to the Auckland Museum and Cheeseman placed them on record. In 1908 an expedition including Tom Iredale and myself camped on Raoul Island for ten months. Iredale published his observations in the *Emu* and the *Transactions of the New Zealand Institute*, my own being included in the present volume. Subsequent to our expedition Mr. R. S. Bell made detailed observations on some of the species (white tern, spotless crake). Guthrie-Smith visited the Kermadec Islands and published his observations in *Sorrows and Joys of a New Zealand Naturalist*. Later J. H. Sorensen spent several months on Raoul Island and made a close study of the birds.

CHATHAM ISLANDS

The first information regarding the birds of the Chatham Islands was obtained by Dieffenbach who visited the group in 1840. The results were recorded by Gray in the appendix to Dieffenbach's *Travels* and in the report of the *Erebus* and *Terror* expedition. Buller visited the islands in 1855 and H. H. Travers in 1871, the latter collecting many specimens which were identified by Hutton. In 1892 H. O. Forbes visited the Chathams and later published a paper on the birds. Gilbert Archey and C. J. Lindsay spent several weeks in the group in 1923 and later published a list of the birds observed. It remained for C. A. Fleming and E. G. Turbott to make a more thorough study of the birds of the Chatham Islands. In December, 1937, two weeks were spent in the group and visits were made to Pyramid Rock and Southeast

Island, two very difficult places to climb. Among birds of especial interest they found breeding on Southeast Island the Shore Plover and the Chatham Island Yellow-fronted Parakeet. A full and well illustrated account of the birds was later published by Dr. Fleming in the *Emu.*

Stewart Island

Though possessing an intensely interesting avifauna Stewart Island and its off-lying islets were for a long time neglected by ornithologists. In Buller's *Supplement* only 13 species are mentioned from Stewart Island though as early as 1872 Professor J. G. Black published a list of 21 species. The first important account was contributed by Dr. L. Cockayne in his *Botanical Survey* of the island, from information supplied by Mr. T. Bragg. The whole of Guthrie-Smith's work *Mutton Birds and other Birds* (1914) and a considerable portion of his *Bird Life on Island and Shore* (1925), are devoted to the birds of Stewart Island and the offlying islets. A complete list with notes of the birds of this region was published by myself in 1926. No New Zealand ornithologist has delved more deeply into the life histories of the sea birds of New Zealand than has L. E. Richdale. He camped for months at a time on Whero Island off Stewart Island and made detailed studies of the habits of individual birds and recorded the weights of chicks from hatching until they were fully fledged and flew to sea.

Southern Islands

The subantarctic islands of the New Zealand region, other than Macquarie Island, have received a good deal of attention from ornithologists. In 1839 the *Astrolabe* and *Zelee,* with Hombron and Jacquinot as naturalists, visited the Auckland Islands and discovered there the merganser and the yellow-eyed penguin. In March of the following year the *Porpoise,* of the United States Exploring Expedition, put in at Port Ross, Auckland Island, and stayed three days. An example of the Auckland Island snipe was taken on this occasion. In November following, the British expedition in the *Erebus* and *Terror* stayed for some weeks at both the Auckland and Campbell Islands. Filhol called at Campbell Island in 1884 and collected a number of birds. But the islands became far better known after the New Zealand Government steamer *Stella* began to make annual visits to search for castaways. This afforded an opportunity for Reischek to make a trip, in 1888, and F. R. Chapman in 1890, both publishing accounts of their visits. In 1902 the *Southern Cross* called at Campbell Island and collected birds. An expedition organised by the Canterbury Philosophical Institute visited the Auckland and Campbell Islands in 1907 and a general account of the birds by E. R. White was included in *The Subantarctic Islands of New Zealand* published by the Institute (1909). Other visits which added to our knowledge of the avifauna of the Southern Islands were made by Archey, 1923, Rollo Beck, 1926, Guthrie-Smith and myself, 1927, Stead, 1929.

During the war years 1942-1945 watching stations were established on the Auckland and Campbell Islands. After the war a permanent meteorological station was set up on Campbell Island. The staffs during the war years included botanists, geologists and zoologists. Extensive collections of all groups of plants and animals were made and distributed to various museums. The general account of the birds has not yet been written but Sorensen has published accounts of the royal albatross and the light-mantled sooty albatross in the reports of the expedition so far issued.

The Snares Islands were visited by two expeditions in 1947-1948. The first, December 1947, consisted of about twelve members including Dr. and Mrs. R. C. Murphy, E. F. Stead, C. A. Fleming and R. A. Falla. Dr. Murphy collected material for a habitat group in the American Museum of Natural History and the others gathered much information about the birds. During this trip the cape pigeon was found nesting on the Western Reef. In January-February, 1948, L. E. Richdale and W. M. C. Denham camped for six weeks on the Snares. Richdale paid most attention to Buller's albatross and the information he gained has since appeared in a pamphlet entitled *Wild Life on an Island Outpost* and in several monographs on albatrosses.

In 1950 the m.v. *Alert* under Captain A. J. Black visited the Antipodes and Bounty Islands. Aboard were R. A. Falla, E. G. Turbott and R. K. Dell, and specimens, photographs and information were brought back.

Macquarie Island was much visited by the early sealing vessels, but the only ornithological result seems to be the discovery of the king penguin and the subsequent decimation of this species and the royal penguin for their oil. The Russian expedition under Bellingshausen visited the island in 1820 and brought living and museum specimens of a parakeet. In 1840 the *Flying Fish* of the American Expedition landed a boat's crew and collected specimens of the gentoo penguin. The island was visited by J. H. Scott in 1880, and A. Hamilton in 1894, both of whom published information about the birds. The Australasian Antarctic Expedition established a base on Macquarie Island in 1912-13 and some interesting results by G. F. Ainsworth were subsequently published in the narrative of the expedition. Macquarie Island was visited by R. A. Falla as a member of the British, Australian and New Zealand Antarctic Research Expedition in December, 1930, and his observations on the birds were included in his report on the birds of the expedition published in 1937. This report included information collected by H. Hamilton and photographs brought back by the expedition of 1912-1913. In the summer of 1947-48 the Australian Government established a meteorological station on Macquarie Island and this has given opportunities for bird observing on the island.

FOSSIL BIRDS

The history of the discovery of fossil birds in New Zealand is mainly concerned with the moas and this is summarised under that group. With the moa bones were associated bones of other species of birds so the early collections were sent to Owen who described them in his series of articles "On Dinornis" published in the *Transactions of the Zoological Society.* In these papers Owen described two species of large rails, *Aptornis,* a large brevipinnate goose, *Cnemiornis,* and the extinct takahe, *Notornis mantelli.*

In 1867 Haast identified a large eagle among moa bones obtained from Glenmark swamp and he named it *Harpagornis moorei.* Two years later he found and afterwards described a smaller eagle from the same locality, but probably this was the male of *H. moorei.* In the Chatham Islands in 1892 W. Hawkins discovered the bones of a large rail which H. O. Forbes named *Aphanapteryx hawkinsi* referring it to a genus of rails formerly found in Mauritius, and in the same year Forbes himself discovered the bones of a coot associated with the rail. This he named *Palaeolimnas chathamensis.* The last discovery of an extinct bird in New Zealand was made at Karamu, south of Auckland, where, in in 1947, in a limestone cave, members of the New Zealand Speleological Society found the skeleton of a rail. This was described by Dr. Falla under the name *Capellirallus karamu.* The Pyramid Valley moa deposit produced besides moa bones some very good skeletons of *Aptornis.* The subject of the evolution of the extinct birds in New Zealand was discussed by myself in an article published in the *Emu* in 1945.

INTRODUCED BIRDS

The birds introduced into New Zealand for sport, sentiment, or for contending with insect pests have not failed to receive attention. Foremost among investigators was G. M. Thomson who contributed a paper on acclimatisation to the Christchurch meeting of the Australasian Association for the Advancement of Science in 1891. Subsequently he made a more intensive study of the history of acclimatisation in New Zealand, publishing the results in 1922 under the title of *The Naturalisation of Animals and Plants in New Zealand.* The introduced birds were again dealt with in his *Wild Life in New Zealand, Part II,* issued in 1927.

In 1907 James Drummond made an admirable summary in a pamphlet entitled *Our Feathered Friends,* of information supplied by a large number of correspondents in all parts of New Zealand.

An illuminating discourse on the history of the introduced birds on a sheep run in Hawke's Bay was given in Guthrie-Smith's *Tutira,* published in 1921.

The distribution of certain introduced birds has been the subject of studies by L. W. McCaskill on the Australian magpie, 1945; J. M. Cunningham on the Indian Myna, 1948; and G. R. Williams on the Indian chukor, 1950, and on the Californian Quail, 1952.

STRUCTURE OF BIRDS

Birds form a natural and well defined class of vertebrates most nearly related to reptiles. Indeed they may be considered a special development of one of the orders of reptiles. Like reptiles the body covering consists partly of scales, there is a single occipital condyle articulating with the first vertebra, the mandible articulates with the skull through the intermediation of a quadrate, besides other structural characters. The principal features characteristic of birds are the following: the main body covering consists of feathers, the forelimbs are modified into wings, a synsacrum is formed by the fusion of certain sacral and lumbar vertebrae, the bones of the skull are much fused and produced in a beak formed by the premaxilla and lower mandible, the sternum is usually provided with a ventral keel, teeth are absent in Tertiary and Recent species, the gullet is frequently dilated into a crop and the hinder part of the stomach is modified to form a gizzard, the lungs are non-distensible but the bronchii give off branches which open into large air sacs which in turn communicate with pneumatic cavities in some of the bones, the voice is produced in a syrinx situated near the junction of the trachea and bronchii.

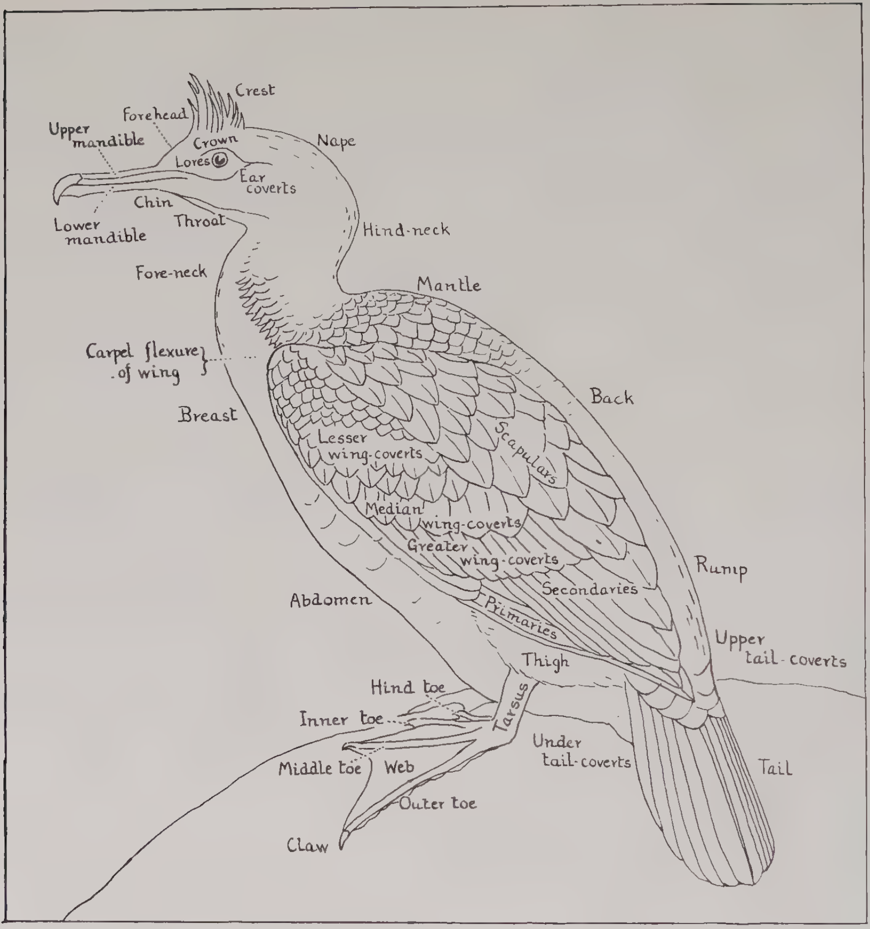
All birds are oviparous and the large ovum containing a relatively enormous quantity of yolk becomes, during its progress down the oviduct, invested with albumen, a shell membrane and a calcareous shell. The shell is frequently ornamented with spots and blotches of a different colour from the ground, and it is the different depths at which these spots lie in the shell that give them different shades of colour in the same egg. The newly hatched young may be naked and pass through a downy stage before acquiring feathers, or the downy stage may be absent, or they may be hatched covered with down in which case they are usually able to run in a few hours.

Further details of the structure of birds need not be given here, but in order to assist those using this book to follow the descriptions a diagram is given of a skeleton and another of the chief feather regions of a bird.

Colour in birds is due to a pigment alone, to a pigment associated with a particular type of structure, or to structure alone. Colours due to pigment alone are black, brown, and red; also, but not always, yellow and, in the touracou only, green. Blue, violet and green are due to pigments combined with structure. If a green feather is hammered it becomes yellow, the colour of the pigment. Similarly the blue of a feather vanishes if it is hammered and a dull black or grey takes its place. In blue feathers the horny coating which contains the pigment takes the form of a series of polygonal cones, while in violet and green feathers the horny part is arranged in thin ridges lying close together. Feathers with a metallic lustre show various colours according to the direction in which they are viewed. This effect is due to the light being broken up by a number of prisms so that the colours, which are only those seen in a rainbow and occur in the same order, would properly be called iridescent. White in birds is never due to a pigment, but to the rays of light being broken up an infinite number of times and reflected.

Colour Varieties in New Zealand Birds

With the evolution of chromosomes and genes a mechanism is provided for the exact inheritance of characters from parent to offspring. There is also in this mechanism a means by which the factors which determine characters can be interchanged. In this way arise many species, subspecies and varieties in nature, and the vast number of


Crest
Forehead
Upper mandible
Crown
Nape
Lores
Ear coverts
Chin
Lower mandible
Throat
Hind-neck
Fore-neck
Mantle
Carpel flexure of wing
Back
Breast
Scapulars
Lesser wing-coverts
Median wing-coverts
Greater wing-coverts
Rump
Secondaries
Abdomen
Primaries
Upper tail-coverts
Thigh
Hind toe
Tarsus
Inner toe
Under tail-coverts
Middle toe
Web
Tail
Outer toe
Claw

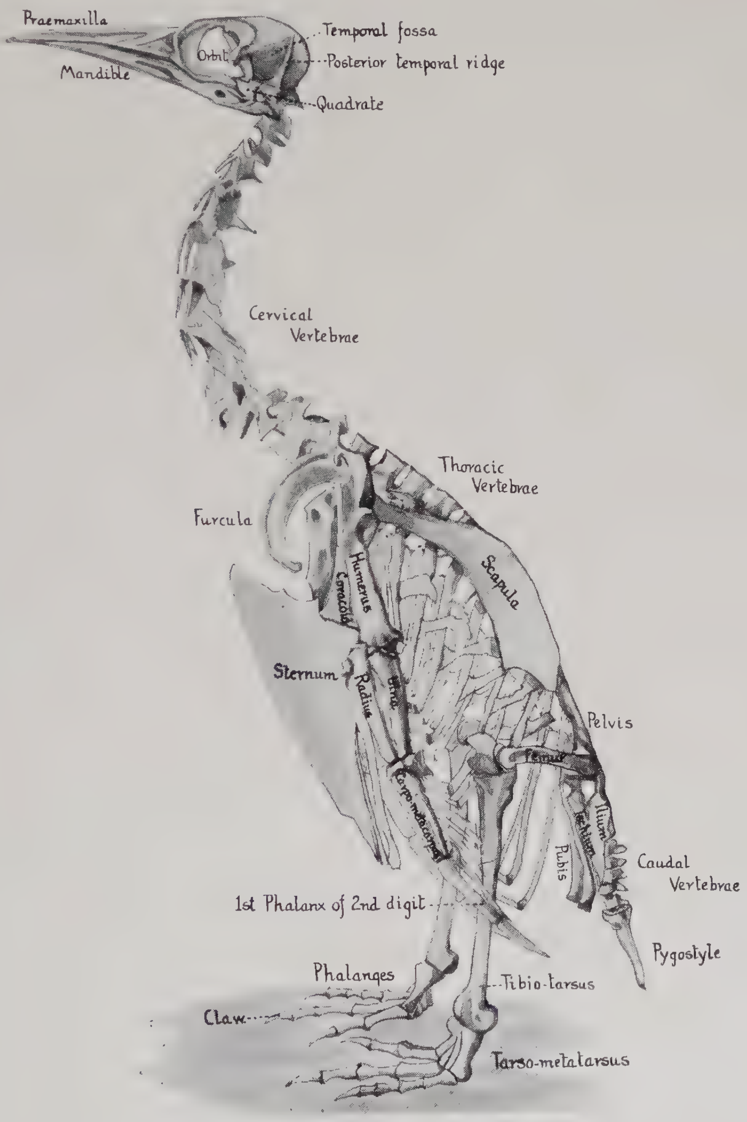
E. H. Atkinson

CHATHAM ISLAND SHAG SHOWING FEATHER REGIONS

varieties of our cultivated vegetables and flowers, and of our domesticated mammals and birds. New Zealand has no genera of birds of any size exhibiting different combinations of characters but examples from small genera can be quoted, for instance, tomtits, kokakos, fantails and *Mohoua* (whitehead and yellowhead), where the differences are best regarded as due to the interchange or segregation of characters determined by genes.

The regular appearance of colour varieties in birds can be interpreted as due to the effect of similar gene rearrangements. If for instance in any species a particular gene or set of genes was prone to become displaced then the resulting kind of colour variety could arise quite independently at different times and places. Thus Buller described a brown and cream coloured variety of tui from New Zealand and years later a bird in almost identical plumage was taken on Raoul Island. That different species should vary in a similar manner should also follow, and so we find that green colours are replaced by canary yellow in such distinct families as parrots, New Zealand wrens and white-eyes. White-breasted wekas have appeared in most of the subspecies.

Of special interest among colour varieties of birds are the black species which habitually pair with pied species when their areas of distribution overlap. The New Zealand avifauna is rather rich in these melanistic birds, the principal ones being the black stilt, black oystercatcher, black fantail, bronze shag and white-throated shag. The black tomtit, being confined to the Snares Island, does not interbreed with any of the pied forms while the black robin and the little black shag have no pied relatives. Crosses between black and pied forms are in most cases birds of intermediate coloration, but in the fantail there have not been recorded any birds with blended plumage, and in the


Praemaxilla
Orbit
Mandible
Temporal fossa
Posterior temporal ridge
Quadrate
Cervical Vertebrae
Thoracic Vertebrae
Furcula
Humerus
Coracoid
Scapula
Sternum
Radius
Ulna
Pelvis
Femur
Carpo-metacarpal
Ilium
Ischium
Pubis
Caudal Vertebrae
1st Phalanx of 2nd digit
Pygostyle
Phalanges
Tibio-tarsus
Claw
Tarso-metatarsus

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SKELETON OF KING PENGUIN

case of the bronze and the Stewart Island shags it is practically the same, though specimens of the bronze shag with scattered white feathers on the under surface have been obtained. Black colour varieties may occasionally appear, as in the erect-crested penguin, but not persist.

There are some facts to indicate that black colour varieties are not "mutants" of pied forms but rather reversions to the original colour of the species, the pied forms being the "mutants". Experiments with rats and rabbits show that the basic colour is black, that whiteness is due to the absence of a colour-producing factor, and greyness to the presence of a "greying" factor. That change from dark to light colours is the normal course in evolution and in growth from youth to maturity, is indicated by the many cases in nature in which the young is darker than the adult. In the white-throated shag the white on the throat actually replaces black in the juvenile bird. A change from black to white would similarly explain the origin of the white reef heron. According to this theory, too, the white egret could be a white species which has replaced a darker bird from which it was derived. That this has actually happened is indicated by the occasional appearance of black feathers in the plumage of the egret.

It is possible that sometimes the stimulus which produces chromosomal change resulting in the production of a colour variety may be some external factor. It has been found in the case of the northern ptarmigan which changes in winter to a white plumage that the colour change is induced by cold, and as white feathers contain air spaces they are relatively warm and therefore become a favourable adaptation to cold conditions.

In the case of the giant petrel more white birds are found the further south one proceeds so that it is possible that it is the lower temperature that induces the appearance of the white plumage.

Adaptive Structures

There is no more fascinating study than the relation between the structure or habits of animals and their surroundings. It is a subject about which a vast amount of observations and a good lot of speculation have been made. Here there is only space to indicate the more obvious features of New Zealand birds which seem to have a more or less definite relation to external conditions. To explain the type of structure as an effect of the conditions to which it is supposed to correspond is not in the present state of biological knowledge a justifiable proceeding.

Birds that habitually dive and swim under water have certain features in common evidently related to progression in a medium heavier than air. They include penguins, diving petrels, shearwaters, grebes, shags and gannets. In the penguins which are highly specialized for swimming under water the body is fusiform or fish-like, the pelvis narrow, the wings modified into flippers, the tail short, the feet placed far back, the plumage short, dense and even, and the nostrils closed. A penguin literally flies under the water as the organs of propulsion are the flippers, the feet being kept straight out behind. Each of the other kinds of diving birds has one or more of the special characteristics present in penguins.

The ordinary swimming birds, such as gulls and ducks, propel themselves with their webbed feet. The scaup, for instance, which habitually swims under water, holds its wings near its body and spreads its feet widely and more or less above the level of its tail. Structurally ducks and gulls are very little modified for an aquatic life other than having the toes connected by a web.

A vast concourse of birds, including all the plovers, and herons and some of the rails, seek their food by wading in shallow water and probing the soft mud or catching fish. Two conspicuous modifications admirably suited to the birds' habits are found in these orders. Firstly the legs are long, and bare to well above the tarsal joints, and the toes are long. Thus the birds are enabled to wade without wetting too much of the plumage while the spreading toes prevent sinking into the mud. Secondly the bill, in the plover order, is often long and slender and thus of special benefit for probing into soft mud.

The ground birds of New Zealand show more remarkable modifications than those of any other class. These take two directions, firstly a reduction in organs connected with flight, including the keel of the sternum, and secondly a strengthening of the legs and feet. The tail is generally short or absent. A very interesting case is provided by the takahe. In this species, when compared with its near ally the pukeko, the body is more robust, the legs stouter and the toes shorter, the primaries much shorter in relation to the secondaries and the plumage softer. Very little difference, however, is seen in the colour of the plumage.

The kiwis are a never ending source of interest on account of their very special features. Like the takahe they are flightless and have strong legs, but in other characters they are still more specialized. The wing is reduced to such an extent as to be no longer visible from without, the tail is completely absent and the bill exceedingly specialized in accordance with a habit of feeding on worms in soft ground and rotting wood. The bill is very long, similar in this respect to the bill of wading birds, especially the curlew, and is moreover particularly sensitive both to touch and smell, it being richly supplied with blood vessels and nerves, and the nostrils are situated at the extreme tip, a unique feature among birds.

The snipes are to all intents and purposes ground birds, possess stout legs, abbreviated wings and a bill very similar to that of the kiwis except that the nostrils are at the base. Like the kiwi too the tip of the upper mandible overlaps the lower thus protecting the mouth while it is being pushed into the ground.

The wekas have completely lost their power of flight, the primaries being reduced to the level of the secondaries and like them have soft webs. As with the other species of ground birds, the legs are very strong.

Finally there remains for mention the kakapo, a large parrot which has adopted a habit of living on the ground. Its chief modification is in its wings in which the primaries are so short that the bird is capable of little more than breaking its fall when descending from a branch to the ground. The keel of the sternum is reduced to a low ridge.

That the total or partial loss of flight through degeneration of the wings is not exclusively a feature of ground birds, but of any bird that assumes habits which do not require the exercise of its wings for flying, is shown by its taking place in a duck in the Auckland Islands and in diving birds like the penguins.

The ordinary birds of the forest present few special features which might be related especially to their surroundings. The only point worth mentioning is that their feet are well adapted for perching by the hind toe being long and on the same level as the others, while in the cuckoos and parrots the toes are disposed two in front and two behind. Such an arrangement no doubt assists in climbing as is the habit of the parrots.

Birds which spend a great deal of time in the air possess long pointed wings and indulge in habits of sailing with the wings motionless. According to Hector, when the wings of albatrosses are fully extended a process on the distal end of the humerus causes a slight rotation of the ulna so that the joint becomes locked thus rendering the wing rigid as far as the wrist joint. At the same time the slight play permitted by the articulation of a patelloid bone on the process of the humerus allows muscular pull from the shoulder to the hand without unlocking the joint.

COLORATION

In the above notes only structural features have been considered, but in the relation of birds to their surroundings, coloration is of some importance. There are few birds that are not preyed on by others so that it would be an advantage if by their colour they were rendered inconspicuous in their normal haunts. Similarly an assimilative coloration would be of advantage to a bird which, seeking its prey, wishes to approach unobserved. The coloration of many birds so resembles the surroundings that it has been considered to have a protective value. However, that the type of coloration is really a heritable family character is shown when a bird, which changes its habits, still retains its colour though it might make it quite conspicuous. A case in point is the Antipodes Island parakeets. These birds, two species, have taken to a life on the ground, including the shore, where they associate with the drab-coloured pipit, yet they still retain their green plumage which is more in harmony with forest foliage.

Examples of the colour of birds resembling more or less the environment can be seen in all the orders. A penguin in the water shows blue from above, but white from below, thus rendering it less detectable for both seal and fish. The dottrels are coloured like the stones among which they live, while their chest bars perfectly assimilate shadows when they are squatting down. Forest birds are frequently green, thus resembling foliage, or brown and spotted, simulating bark; ground birds like the pipit are coloured like the ground. Especially remarkable is the close resemblance between eggs and young birds and their surroundings even when the adult is conspicuously marked. This renders a service during a particularly vulnerable period in the life history of the species. The gulls and plovers furnish excellent examples of this type of assimilative colouring which, furthermore, is rendered more efficient by the habits of the young remaining perfectly still while danger threatens.

GEOGRAPHICAL DISTRIBUTION

New Zealand has not always been separated from other lands for it possesses a fauna and flora which could not have come to it across a wide expanse of ocean. It has, however, been isolated for a very long time because, when it was last of continental dimensions, mammals were not present in sufficient numbers to have reached as far as New Zealand. In that period of the earth's history known as the Cretaceous, great earth movements took place in the New Zealand area, resulting in the folding of a series of strata that had for a long time previously been deposited under comparatively quiet conditions. At that time there was a general uplift and consequently an extension of the land. There was, indeed, a New Zealand continent that stretched far to the north, connecting with a continental area in the region of New Guinea, and also to the south and east so as to include Macquarie Island and the Chathams. This continent lasted for a considerable time, and then the land began to sink, and although it has since more than once been elevated, it never again became united to any other land. The history of New Zealand, therefore, begins when the sea last separated it from other lands.

It would be of very great interest to know the constitution of the fauna and flora of New Zealand at the time of its birth. Unfortunately there is little evidence on this point so we are forced to speculate as to what it was from a study of the relationships of the existing mammals and plants. The birds probably included the ancestors of all those kinds which today have no near relations, such as the kiwis, moas, fernbirds, huia, kokako, saddleback, piopios, New Zealand wrens, and Chatham Island rails. There would also be those birds which later gave rise to the kea, kaka, pigeon and the wekas, species which at present show relationships with Malayan forms; and the ancestors of our laughing owl, bellbird, tui, stitch bird, robins, tomtits and kakapo, which possess Australian affinities. These, that is to say the ancestral species of the birds mentioned, would constitute the starting point of our present fauna. From them by a slow process of change would arise their present representatives. The basis of our land avifauna is thus of northern affinity. Besides these there would be present in the New Zealand continent many sea birds, whose area of distribution would be the whole southern ocean. Chief among them would be petrels, penguins and shags in the south, and gannets, terns and gulls in the north. A third group of birds would be shore birds, including many that spent their breeding season in Asia and wintered in New Zealand.

During the time that has elapsed between the Cretaceous period and the present day there have arrived from time to time visitors from Australia some of which, such as possibly the quail, paradise duck, pipit, morepork, fantail, white eye and spur-winged plover, became established while many more came but failed to establish themselves. Such are the accidental and occasional visitors.

Briefly stated, the birds of New Zealand are derived from an original stock of northern affinity, which coexisted with many widely distributed sea birds and a number of summer visitors. The descendents of these together with a few additions from Australia constitute the present avifauna.

The pattern of the distribution of birds within the New Zealand region and indeed of the differentiation or evolution of the species depends on the position of the islands within the archipelago and on their ages. The two main islands and Stewart Island are separated from one another by straits less than twenty miles in width which is much less than the distance at which the outlying islands lie from the main islands. There are patterns of genus and species structure conforming to this layout. For instance *Miro* (New Zealand robin) has closely allied subspecies of one species on the main islands and Stewart Island whilst on the Chathams is a quite distinct species. Similarly in *Bowdleria* (fernbirds) there are five subspecies of *B. punctata,* all with spotted under surface on the main islands, Stewart Island and the Snares (nearest of the Southern Islands) and a distinct species with unspotted under surface on the Chathams. In the case of the snipes the Chatham Island species contrasts with all the other forms from the main, Stewart and Southern Islands, which together can be included in a species of five subspecies.

Of the outlying islands the Chathams have probably been occupied longest, the Southern Islands for a somewhat shorter period and the Kermadecs for only a comparatively brief time. The Southern Islands may be composed of rocks older than those of the Chathams but during the Pleistocene Period they would be subject to a degree of glaciation which might have wiped out most if not all the life that existed there in Pliocene times. Consequently the islands may be considered only as old as the time that has elapsed since the maximum glaciation. Corresponding with these relative ages the Chatham Islands show the greatest degree of endemism among their birds, the Southern Islands come next and the Kermadecs have only one endemic subspecies. In the Chatham Islands there were three endemic genera of rails, *Diaphorapteryx, Nesolimnas,* and *Cabalus,* and there is a warbler, *Hapolorhynchus.* The endemic species are *Hemiphaga chathamensis, Bowdleria rufescens, Miro traversi, Stictocarbo featherstoni* and *Phalacrocorax onslowi;* and there are endemic subspecies of *Rhipidura, Petroica, Prosthemadera, Anthornis and Cyanoramphus.* All these make the group a well defined province of the New Zealand region. The Southern Islands contain the endemic species *Petroica dannefaerdi, Cyanoramphus unicolor, Anas aucklandicus, Mergus australis* and *Phalacrocorax campbelli.* There are endemic subspecies of *Anthus, Petroica, Bowdleria, Anthornis, Cyanoramphus, Sterna* and *Coenocorypha.* These islands may be said to form another geographical province. In the Kermadec Islands only a subspecies of parakeet is endemic.

In the main islands the most important east-west dividing line is Cook Strait. Genera which do not pass this barrier either from the north or from the south are *Traversia, Notornis* (present distribution only), *Finschia, Notiomystis* and *Heterolocha*; also two moa genera, *Emeus and Megalapteryx.* Cook Strait acts as a barrier to species in the following genera: *Turnagra, Mohoua, Nestor* (*notabilis*), *Phalacrocorax, Aptornis, Pachyornis, Zelornis, Euryapteryx, Anomalopteryx, Dinornis, Callaeas.* Subspecies of the following genera are also separated by Cook Strait: *Philesturnus, Bowdleria, Petroica, Miro, Rhipidura, Xenicus, Acanthisitta, Sceloglaux, Nestor, Gallirallus* and *Apteryx.* There is little endemism among the birds of Stewart Island. Endemic subspecies of *Apteryx, Coenocorypha, Xenicus* and *Bowdleria* occur there.

MIGRATION

Nearly all species of birds move from one place to another during the course of their lifetime. The movements of many of these are regular and correspond to seasonal changes; such being usually referred to under the term migration. Some species, perhaps through force of circumstances, such as those on small islands, are stationary, but on the mainland, where there is more room, birds regularly move in accordance with the incidence of food supplies which in its turn is determined by seasonal changes. Accordingly there may be regular seasonal movements, between higher and lower levels or between localities in different latitudes. The flowering time for trees is, in the lowlands, in advance of what it is in the mountains. Consequently some bush birds are found in the valleys and near the sea coast in spring but later in the season move to high levels. In winter time some birds leave the bush and come out into the settled districts. In addition to these local seasonal movements there are more erratic ones such as the irruption of large numbers of birds from the forest when food fails, as has happened with the parakeets, and the occasional migrations of the weka.

The longer seasonal movements may be classed under three heads: (1) within New Zealand; (2) birds breeding in New Zealand and wintering to the north; (3) summer visitors breeding outside New Zealand.

Migration within New Zealand. A few species of New Zealand birds regularly move northwards in the autumn and southwards in the spring. The wrybill plover is known to breed only in the South Island, but it spends the winter in the North Island. The sand plover was said to have had similar migratory habits. Banded dottrel which breed in Canterbury spend the winter further north, but those breeding in the North Island move towards the coast in winter. Some of the species of penguins which breed in the islands to the south of New Zealand regularly leave the islands in winter but their destination is unknown, though some, like the erect-crested penguin, regularly comes as far north as the seas of New Zealand.

Migrants Breeding in New Zealand. Two distinct groups of birds breed within the New Zealand area but winter in the north. The two species of cuckoo arrive in the north or north-east of New Zealand in September and quickly spread throughout the country. They leave again during February. To the second group belong two or three species of shearwaters. The flesh-footed shearwater breeds in Australia and New Zealand and then migrates northwards to the western North Pacific. The sooty shearwater likewise breeds in the Southern Hemisphere and winters in the northern. The short-tailed shearwater, not known to breed in New Zealand, also regularly migrates between the northern and southern hemispheres.

An observation which may be of some interest in connection with the migration of the long-tailed cuckoo has been related to me by Mr. A. S. Wilkinson of Kapiti Island. He states that a cuckoo pursued by tuis flew out to sea and, diving into the water, stayed beneath the surface while his pursuers turned back to the shore. The cuckoo then flew out of the sea and returned to the island. It is evident, therefore, that the cuckoo would not necessarily be drowned if during its migration flight it attempted to rest on the sea.

Migrants Wintering in New Zealand. To this group belong a large number of waders, or members of the Order Charadriiformes, which breed in northern Asia or North America during the northern summer and spend the southern summer in New Zealand. In addition to the waders, the arctic tern and the parasitic jaeger breed in the Arctic regions and visit New Zealand in the southern summer. Some of the birds of several kinds of waders and the jaeger stay over the winter in New Zealand. For the waders there appears to be a regular migration route from Eastern Siberia down the east coast of Asia and through the Malay Archipelago to New Zealand. Some species of birds which breed in Alaska cross Behring Strait and join the Asiatic migration. The waders which thus twice a year journey a distance of over 6,000 miles, include the godwit, turnstone, golden plover, knot and several other species which come in lesser numbers.

The origin of bird migration and the reasons for keeping to certain routes, especially those which cross wide spaces of ocean, are questions which it is not possible to answer with any certainty but on which the evidence derived from small local migrations throws some light. Most bird movements are determined by the incidence of the food supply which as a rule varies with seasonal changes. Consequently regular migratory movements corresponding with seasonal changes might thus be explained In fact they can be observed in almost any region with well-marked seasons. More difficult to explain, however, are the movements of birds beyond the limits necessary to procure food and across oceanic areas where there are now no guiding land lines. Migration is more prevalent in some groups of birds than in others, which indicates an inheritable disposition to move in accordance with some stimulus such as a change in temperature. Habits once acquired tend to be repeated more expeditiously and consequently in a habit involving movement there would always be the tendency to overshoot the mark. In other words the limits would gradually become extended, especially with species inheriting the migratory habit. That this habit is strongly inherited is proved by the fact that young birds are often the last to leave the breeding grounds and migrate without guidance from their parents. The long migrations, according to this theory, are due to the gradual extension of shorter movements occasioned in species having strong migratory instincts. With regard to the question of finding their way across the ocean, Hutton long ago suggested that originally they followed a shore line which gradually disappeared while the migratory habit persisted until now the birds cross trackless wastes of ocean.

CHANGES IN THE FAUNA

One must travel well off the beaten track to find a place where bird life in New Zealand is near its primitive condition. In all parts of the mainland there have been changes by the elimination of one or more species. Once common and widely distributed birds, such as the piopios for instance, have almost disappeared. Consequently, even in the remotest parts of the country bird life is not as it used to be when Europeans first arrived. On certain islands, however, it is practically in its pristine state. The forest of Little Barrier Island still rings with the song of bush birds, and so too do those of Kapiti and Resolution Islands, while some of the southern islands will long remain, thanks to their inhospitable climate, splendid examples of what nature was like before the coming of the white man.

But before the white man was the Maori, and before the Maori a fauna which differed conspicuously from that of immediate pre-European days, for it contained huge wingless birds, the moas, in great variety. The extermination of these must surely have been brought about by the Maori race.

The change has not been altogether one of the disappearance of native birds and their replacement by introduced species. Many kinds have gone and left nothing in their place unless one counts rats and other vermin. In the settled districts the change is complete. Fields and plantations replace native forest; European, Asiatic and Australian birds meet the eye on all hands; here and there only is a native bird to be seen. The principal indigenous species that have taken kindly to the human environment are the kingfisher, grey warbler, fantail, tomtit, silvereye, pukeko, pipit and morepork. No doubt others such as the pigeon, grey duck and possibly the parakeets would do so if they were allowed.

The principal species which have become extinct or have been materially reduced in numbers since the settlement of New Zealand by Europeans are the following: huia, quail, piopios (two species), kokakos, stitchbird, bellbird, kakapo, kiwi (three species), robins (two species), saddleback, laughing owl, bush wren, fernbird, and rails (two species in Chatham Islands). All species of land birds have, of course, suffered some reduction in numbers through the changes brought about by European settlement.

Looking for the causes which have led to reduction or, in a few cases, actual extinction, we find four main ones, and a number of minor ones which may be grouped together in a fifth category. The five groups are: (1) change of conditions through settlement; (2) introduced mammals and birds; (3) commercial collectors; (4) sportsmen; (5) various other causes.

Change of Conditions. The progress of settlement in New Zealand, involving the destruction of forests, draining of swamps, and burning of scrub, to make way for pastoral and agricultural pursuits, has introduced over considerable areas conditions which only a few of the native species of birds can tolerate. The settled country, therefore, which is yearly increasing in area at the expense of the territory under primeval vegetation, alone accounts for the reduction in numbers in nearly all the indigenous species of land birds. The proportions of the land surface of New Zealand occupied by man is about 65 per cent. of the total area. From this cause alone, therefore, without reckoning the extension of its effects into the virgin areas, a considerable reduction in the bird life generally is to be ascribed. Perhaps the only species which owes its extinction mainly to advance of settlement is the native quail, the larger part of whose area of distribution seems now to be occupied by man. The fernbird has been undoubtedly reduced in numbers through the drainage of swamps, while the paradise duck has no doubt suffered much through its natural habitats being occupied by man.

Introduced Mammals and Birds. Without doubt the mammals and birds, more especially the mammals introduced by man, have had the most far-reaching effects on the native avifauna. The introduction of this ecological unit has completely disturbed the former balance of avian life in every kind of natural formation and almost to its utmost limits. No tract of country is now without its quota of rats and stoats. The weka, thanks to its cunning and its strength, is a match for the rat, and thus, according to Guthrie-Smith, acts as a protector to the small birds. There can be no doubt now that rats and stoats are among the worst enemies of the smaller native birds, and that they are increasing throughout the country. The rats commonly met with in the forest in New Zealand are the brown and black rats. On Raoul Island I have observed the depredations of the native rat (*Mus exulans*), which is also found in New Zealand, and have found nest after nest of the tui destroyed. Robins, bellbirds and suchlike are reduced, through destruction of eggs and young by rats, and possibly the near extinction of the piopios, stitchbird and saddleback is to be ascribed to the spread of the same animals.

It is unnecessary to go into the crime list of the stoat, which is an unmitigated evil in the New Zealand bush, but this carnivore is credited with the decimation of the laughing owl, kakapo and the wrens, and no doubt assists in destroying the kiwi. There is a certain amount of evidence to show that the opossum does harm to native birds by defoliating fruit-bearing trees and also eating the young of forest birds. As a destroyer of the forest, the deer also must be placed in the front rank of introduced mammals harmful to birds. Dogs perhaps do most damage to the kiwi and weka, some of them making a specialty of hunting these ground birds. Dogs, too, seem to have been one of the main factors in the extermination of the native quail. Cats are credited with the extinction of the Stephen Island wren.

Introduced birds for the most part displace native species by taking their food or occupying their nesting places. The little owl, however, takes its toll of small native birds. But introduced birds spread little into the forest, hence their effect is mainly involved in the change of conditions brought on through settlement.

The disappearance of native birds in the forest and scrub thus seems to have been in the main due to rats and stoats. The smaller bush birds and the ground-laying species have suffered most, hence the piopios, kokakos, robins, kakapo and kiwis have come to be rare birds in most parts of the country. Deer and opossums are becoming an ever increasing menace of bush birds.

Commercial Collectors. All persons who in the past have collected birds in large numbers for private collectors and museums within and without New Zealand may be here classed. As the peculiar land birds were made the special object of such collections, large numbers of huias, stitchbirds, piopios and other kinds were taken. It is certain that an appreciable reduction in the number of huias and two or three species of rails in the Chatham Islands took place as a result of this wholesale collecting.

Sportsmen must be credited with causing a certain amount of reduction in the numbers of some of the native birds. Naturally the edible species are most sought after, and thus it is that the native quail, pigeons, kakas, parakeets and various kinds of ducks have felt most the activities of sportsmen. Kakapos, which were formerly abundant in the Makarora Valley, were cleared out by the men employed in forming the road. That the sportsman is a real factor in the reduction of edible birds is proved by the case of the paradise duck and Chatham Island pigeon, both of which have increased since they were protected by Act of Parliament.

The various miscellaneous causes of the reduction of birds are those which are generally not appreciable, as the numbers taken do not exceed those falling to the ordinary causes of nature, such as birds of prey, storms, failure of food, and accidents. They include the taking of birds for pets, which all bushmen practised; bird skin and egg collecting for private collections and local museums; and, lastly, the shooting of birds or robbing nests by farmers, or by others on behalf of local bodies, because the birds are thought to be harmful.

In summary of the causes leading to the reduction and extinction of birds in New Zealand it may be said that the advance of settlement, by changing the conditions, accounts for a considerable reduction in all species, of which one has suffered total extinction; that the main cause of serious reduction and of extinction has been the introduction of rats and stoats; that commercial collectors have assisted in the reduction of the peculiar land birds, with one or two extinctions to their credit; that sportsmen have succeeded in reducing the numbers of some edible species; and that other causes have had little appreciable effect, for, although war has been waged on the kea, harrier, falcon, and shag, none of these species has suffered serious reduction in numbers, which shows the real causes of extinction in the New Zealand avifauna are to be found in the more subtle biological disturbances such as the relentless work of the rat and stoat, the loss of food, change of conditions, and possibly the spread of disease.

It is obvious from the foregoing that in order to conserve our native birds they must be protected from rats and stoats, and their natural habitat, the forest, protected from destruction by deer. Other causes that have assisted extinction of native birds in the past are now negligible under the present protection laws. The clearing of forest and draining of swamps incidental to the advance of settlement cannot be stopped, but these by themselves can scarcely lead to the total extinction of any species. There are thus only two things to do—wage war on the rats, stoats and deer, and transfer birds to sanctuaries where these animals do not exist. The second is the safer method, as the first would be a slow process, and some species of birds might succumb before any appreciable effect was made on the introduced mammals.

Although the changes that have taken place in the avifauna of New Zealand since the advent of the white man, as described above, have been mainly losses, there have been some gains among those species which find their food in open country. The abundance of insects and other food in cultivated land has led to increases in such species as tolerate human beings, namely, pipits, harriers, silvereyes, pukeko and stilts, while the refuse of towns and factories has caused our three species of gull to increase greatly in numbers.

The impact of the introduced fauna, including man, on the indigenous birds is noted for each species under the heading ecology.

ECONOMIC VALUE OF BIRDS

The three groups or organisms which today struggle for mastery of the organic world are bacteria with their allies protozoa, insects and man. Looking upon any kind of animal that assists man in the fight against the other two forces as of value, then birds must be given a place of first importance among animals of economic value. For, of all the animals that assist man in the destruction of insects, birds are the most helpful. Added to this they are of great aesthetic and scientific interest. They do comparatively little damage to agriculture and are very seldom dangerous as disease carriers. This is no doubt due to their clean open-air habits which also makes any harmful species of bird easy to control. The same circumstance unfortunately renders them particularly vulnerable and has in large measure led to the reduction of many indigenous species, so that protective legislation and, what is equally important, a proper appreciation of the worth of birds, are necessary to preserve the balance needed in nature to check insect aggression against man. In addition to being insect eaters on an enormous scale, birds are of considerable value in the economy of a forest by cross pollinating flowers and distributing seeds.

Throughout this work the beneficial and harmful properties of the species are given under the heading ecology. It is only necessary, therefore, in the present place to state in general terms the good and harm that birds are to agriculture.

Most of the important industries in New Zealand are founded on pastoral products. The exportation of butter, meat and wool has indeed always been the mainstay of the country. The success of the pastoral industry depends on a continuous supply of good grass feed. Grass is subject to destructive pests in the form of larvae of certain beetles (*Odontria zelandica*) which eat the roots, and caterpillars (*Porina* spp. Noctuids) which feed on the leaves. In the early days of farming in New Zealand, the native birds retreated before the progress of settlement with the result that the grass-eating insects increased enormously and caused such destruction that they ruined large areas of pasture. To fight this scourge birds were introduced and they well repaid the trouble and expense of their importation. Some species such as the house sparrow and starling have increased to such an extent as to become a nuisance, and thus the fact that they are really necessary to safeguard pastures is liable to be overlooked. However, there cannot be any disputing the statement that without an adequate supply of birds the pastoral industries in New Zealand could not exist.

The position with regard to other cultivated crops in New Zealand is not different from that of pasture grasses. Every kind of cultivated plant, be it cereal, root crop, fruit, or flower, is liable to be destroyed by insects unless they are effectively checked. We endeavour at huge expense to poison the insects with sprays, but were the right kind of birds present, much of this would be saved. Birds work much more efficiently and cheaply than sprays. Silvereyes in a few hours or days can clean up an orchard or rose garden of scale insects and aphides, and many other species of native New Zealand birds could do the same if allowed, but they are discouraged by our domesticated cats, rats and other introduced mammals, and, in some districts, by the imported little owl.

With regard to plantations and native forests, the same relations between plant, insect and bird obtains, and in addition the necessary services of pollination and seed dispersal are in part carried out by birds. Every part of the forest has its particular species of bird attending to its insect inhabitants. On the ground it is kiwis, wekas, robins, tomtits and, formerly, piopios; the tree trunks and branches are thoroughly exploited by the rifleman, bellbird, grey warbler, saddleback and kaka; while the fantails are the chief exponents of taking insects on the wing, an occupation in which the morepork and other bush birds also assist.

In New Zealand, plagues of insects are now so rare that we are apt to overlook the real cause of them being kept in check. This happy state is, however, entirely due to the fact that the balance between birds and insects is unfavourable to the latter. Certain species of birds, however, have increased beyond their usefulness and have themselves caused a considerable amount of damage to cereals and fruit. Nevertheless the damage done is in reality small compared with the enormous benefit of maintaining the very existence of the same crops. To deal with the small bird nuisance, a species of owl has been introduced. It has, however, quite naturally, taken to killing birds other than the harmful ones and is attacking the indigenous species. The policy of introducing a harmful kind of bird (or mammal) to eradicate another is always likely to prove disastrous through the new animal getting beyond control.

SPECIES AND SUBSPECIES

The unit of the taxonomist for the past two hundred years has been the species. On this and on groups of allied species Linnaeus based, in 1753 for plants and in 1758 for animals, the binomial system of nomenclature which at once brought order and precision into the naming of organic beings. Subspecies, which involve the use of trinomials, were used in a few instances by Linnaeus, but their use in the present century has become quite general and now it is proposed in several branches of zoology to adopt them much more widely. This is especially evident in birds in which class Mayr proposes to reduce the number of recognised species from about 27,000 to 8,500. In other words 18,500 generally accepted species are reduced to the rank of subspecies. It must not for a moment be supposed that our taxonomy has been grossly at fault, that is, there are really only one third as many bird species as we thought. It is merely the application of an idea, that of lumping together in polytypic species units that we have hitherto considered, and most people other than certain ornithologists will continue to consider, good species.

The excessive splitting of genera and species of birds practised by Sharpe in England, Ridgway and others in America and Mathews in Australia has naturally led to a reactionary movement and like most such reactions the pendulum has swung too far the other way. In other words there is a tendency nowadays to excessive lumping. This is seen in Peter's *Checklist of Birds of the World,* the British and New Zealand *Checklists* recently issued and in the proposals of Mayr. These lists have rather put the names of birds in the melting pot and so I have had to use my own judgment as to which combination of names best expresses a natural system of classification. Our system of nomenclature loses much of its usefulness if changes in ideas of classification, especially those not based on careful research, lead to extensive changes in binomial and trinomial names. Unfortunately change is inherent in our binomial system because it reflects classification which of necessity must alter with advances in knowledge. All the same we could attain a considerable degree of stability if we could agree generally on our concepts of species and subspecies. In this book, in the desire to stabilize our bird names, I have followed the New Zealand *Checklist* except in those cases, and there are a considerable number of them, where I think there are good reasons to adopt a different standard for genera, species and subspecies from that used in the *Checklist,* if, indeed, it can be said that any standard of species was used in the *Checklist.* In almost all cases in the present volume the reasons are given under the heading status. It is most desirable that we attain a fair degree of stability in our bird nomenclature and to this end I give definitions of the terms species and subspecies and give reasons for rejecting some of the proposals for lumping certain groups as adopted in the *Checklist.* Checklists so far issued have differed, thus showing disagreement in principle and a lack of considered definitions of the terms species and subspecies.

Mayr proposes a definition of a species based on biological grounds. These grounds mainly concern reproductive isolation and as we know very little about the ability of allied forms to cross and experiments are not practicable he is forced to include in his definition "potentially interbreeding natural populations". This simply means that whether or not a form is a species or subspecies depends on the opinion of the taxonomist, as in fact has always been the case. If we could agree to definitions of species and subspecies this personal factor would diminish. Mayr rather discredits the system of classifying on morphological characters, calling the process static, but in reality the limits of his species are almost entirely decided on morphological grounds. Taxonomic units throughout the plant and and animal worlds must of necessity, in the vast majority of cases, be defined on morphological characters. It would be ridiculous to say that morphological characters are not, equally with degree of reproductive isolation, biological. Running through Mayr's scheme is the principle of geographical isolation as a condition for the evolution of species. Nothing is more true than this but, as is evident in the New Zealand *Checklist*, this principle has been extended beyond reasonable limits by considering every allied geographical unit, especially island forms, as a race or subspecies even though the morphological characters are so distinctive as to make it impossible for two such subspecies to be included in a single description.

Put into practice Mayr's scheme, as stated above, reduces the number of species of birds in the world from 27,000 to 8,500; it reduces the number of species of Australian birds from 707 to 651 and of New Zealand birds from 230 (in 1930) to about 205 (excluding species added since 1930). All zoologists must accept the principle of polytypic species. Opinions will differ as to what geographical races should be included in each species. In his book on the finches of the Galapagos Islands Lack admits many subspecies but where the morphological differences in island forms are considerable he ranks them as full species. I agree with this principle and so in such cases as the whitehead and the yellowhead and the piopios treat them as species instead of subspecies as is done in the New Zealand *Checklist*. In one case Mayr includes eighty subspecies in one species. It would in my opinion be preferable to call such an assemblage a species group or superspecies and thus preserve the binomial names for many of its members. Whatever course is adopted the problem of relationships still remains where it was and still requires intensive study.

Mayr's definition of a species is inadequate. It does not allow anything for morphological characteristics nor for the degree of polymorphy in a group. Let me illustrate this by some examples. In the New Zealand *Checklist* the New Zealand quail is rated as a subspecies with the Australian quail (*Coturnix pectoralis*). But the New Zealand form is unitary whereas the Australian one is dimorphic. Here are therefore two biological concepts and as such, in my opinion, should be treated as two species.

In a similar way the fantails *Rhipidura* form two units biologically different. One is unitary (*R. fuliginosa*) the other (*R. flabellifera*) comprises three subspecies. It is in my view quite unscientific and at variance with what we find in nature to admit only the three pied subspecies and to treat the black form merely as a colour phase with no taxonomic or nomenclatural status. Nature has produced melanistic birds breeding among themselves and reproducing their kind and it is the duty of ornithologists to recognise them in their classification schemes.

There are other genera in which, in the *Checklist*, several forms are linked together as a single species but which can be divided into two or three similarly defined biological groups. *Bowdleria*, *Coenocorypha* and *Gallirallus* are examples. *Bowdleria*, according to the *Checklist*, comprises one species of six subspecies. It includes five with spotted breasts and one with the undersurface unspotted and furthermore with a rufous instead of an olive brown general coloration. Here are therefore two groups biologically defined and should be listed as different species. The fact that the fernbirds fall into two natural groups is not brought out by listing all the forms as subspecies of one species.

There are in New Zealand a number of melanistic forms with pied counterparts. These, although probably all due to similar genetic groupings, are treated in the *Check-list* as species, subspecies or not recognised at all nomenclaturally. Furthermore, a pied form with its black companion (*Phalacrocorax chalconotus*) is given only subspecific rank with other pied forms, but surely a pair of semispecies, that is, a dark and a pied one, differs biologically from a pied form that has no melanistic counterpart. The black and the pied forms of the same genus often interbreed and so they are semispecies as defined by Mayr. It is obvious that our taxonomic grades, species and subspecies, do not properly reflect the different biological groups as found in nature. An intermediate grade is required for those species which differ from each other morphologically but have not yet attained full physiological, i.e., reproductive differentiation. For these the grade semispecies is here adopted, each semispecies being given a bionomial name with the word semispecies added, thus *Phalacrocorax chalconotus* (semispecies).

As to the question of hybridisation I agree that in most cases it shows close consanguinity although among plants there are numerous intergeneric hybrids. Among New Zealand birds there are two instances of interspecific hybrids, namely, the banded dotterel (*Charadrius bicinctus*) crossing with the red-capped dotterel (*C. alexandrinus*), and the brown duck (*Anas chlorotis*) crossing with the grey duck (*A. supericliosa*). These are of course only occasional crosses. The regularly crossing forms are the semispecies, either a black and a pied, or a normal and a white bird as in the reef heron. Regarding the status of hybrids I am inclined to agree with Fisher who says: "Two animals do not necessarily belong to the same species if they interbreed in the wild. There are many examples of distinct species which have increased their range in the course of evolution so as to overlap. In the region of overlap they may interbreed, producing a mixed hybrid population." As examples illustrating this the North Island pied oystercatcher and the black oystercatcher might be quoted.

Stability is unlikely to result either from excessive splitting or excessive lumping. A middle course such as is taken in the first edition of this work, or in Serventy and Whittell's *Birds of Western Australia,* or in the present book, is most likely to lead to a stable system of nomenclature. To attain uniformity it is first necessary to have some kind of agreement on a definition of a species. It must include all the principal biological characteristics. I suggest the following, which I have followed in the present work: Species are groups of populations which are (1) morphologically similar, (2) habitually interbreed and reproduce their like, and (3) show the same degree of polymorphism. Under morphology I include colour.

The first condition would separate specifically the North and South Island piopios, and the whitehead from the yellowhead; the second combined with the first would separate the Snares tomtit as a species; and the third would separate the New Zealand and Australian quails (*Coturnix*), and the Chatham Island fernbird as a species different from the other forms of *Bowdleria* which together would constitute another species. Other instances are given in the course of the book under the heading status. Species have well marked distinctive characters and mostly do not cross even when living in the same area. Species that have well marked morphological characters but which cross-breed when their areas of distribution overlap and produce hybrids, usually with intermediate characters, may be called semispecies. Examples are the black and the pied fantails, the black and the North Island oystercatchers, and the little pied and the white-throated shags. Subspecies differ from one another usually in characters that show some intergradation in size, colour or other features. When their areas of distribution overlap they almost always freely cross.

The above definitions can only be guides as it is quite impossible to give a rigid exclusive definition of taxonomic groups that are closely related.

CLASSIFICATION

The arrangement of the orders follows my own views on evolutionary sequence. I have placed the waders before the gulls because the Lariformes as a whole are more specialised than the Charadriiformes. Within the Lariformes the gulls and skuas come first because they are less specialised than the terns. The ducks are specialised for an aquatic life and they show affinities with the screamers which in turn are related to the game birds. I have therefore moved the gulls to near the top of the Larimorph series. The hawks, perhaps doubtfully, fall within the same series, and I have placed the owls near them because of the close resemblance of the skeletal features of these two groups. The Coraciiform birds and parrots, being more specialised than the Passeriformes, are placed after them.

The main differences in the classification adopted in this book from that in the New Zealand *Checklist* are (1) acceptance of the following ten genera which, in my opinion, are adequately differentiated from their allies: *Thalassarche, Stictocarbo, Morus, Pluvialis, Catharacta, Nesolimnas, Cabalus, Demigretta, Traversia, Miro;* (2) retention of three genera, *Casarca, Spatula* and *Crocethia,* which are accepted in the British *Checklist* but not in the New Zealand one; (3) retention of *Capella* on grounds of priority; (4) omission of the following subspecies as not satisfactorily substantiated as members of the New Zealand avifauna: *Daption c. capensis, Pachyptila salvini crozeti, P. crassirostris eatoni, P. d. banksi, Larus n. novaehollandiae*; (5) altering the status of various forms, chiefly reinstating subspecies of the *Checklist* as species. Some species are transferred to other genera and some names are disallowed as indeterminable; (6) adding to the list *Phaethon lepturus, Charadrius melanops* and *Casarca tadornoides* and including a note on eagles.

KEY TO NEW ZEALAND ORDERS

The key on the next page is not altogether a natural one and it applies only to the indigenous species. Small groups, which are exceptions in certain orders, are shown in brackets. The orders too are not given in the same sequence as they appear in the book.

KEY TO NEW ZEALAND ORDERS

- Wings not visible externally. Feathers without barbs .... *Kiwis*
- Wings modified into flippers. Feathers scale-like .... *Penguins*
- Wings present and normal. Feathers with barbs.
  - Toes margined by broad webs.
    - Bill stout. No frontal shield .... *Grebes*
    - (Bill stout. Frontal shield present .... *Coots*)
    - (Bill slender .... *Phalaropes*)
  - Toes fully webbed.
    - All four toes connected by a web .... *Pelecaniformes*
    - Three front toes connected by a web.
      - Bill hooked at tip. Nostrils in tubes .... *Petrels*
      - Bill straight or decurved at tip .... *Gulls, Terns*
      - (Bill slender, upcurved .... *Avocets*)
      - Bill broad, depressed, provided with lamina on each side .... *Ducks*
  - Toes not webbed or small web at base. Legs often long; lower part of tibia bare.
    - Bill slender. Hind toe short or absent .... *Plovers*
    - Bill stout. Hind toe well developed .... *Rails*
    - Bill long and stout. Hind toe long .... *Herons, Ibises, Spoonbills*
  - Toes not webbed, but sometimes united at base. Legs usually short; tibia feathered.
    - Toes two in front, two behind.
      - Bill strongly hooked .... *Parrots*
      - Bill slightly arched .... *Cuckoos*
    - Toes three in front, one behind. Wing moderate.
      - Bill strongly hooked.
        - Tarsus bare .... *Hawks*
        - Tarsus feathered .... *Owls*
      - Bill straight or curved.
        - Legs stout. Bill short, arched.
          - Bill not tumid at base .... *Quail*
          - Bill tumid at base .... *Pigeons*
        - Legs slender. Bill various.
          - Toes parallel, united basally .... *Coraciiformes*
          - Toes diverging, free .... *Passeriformes*
    - (Toes four in front or wing very long .... *Swifts*)

In the keys throughout the book the sequence is as far as possible a natural one so that it is not unprofitable to study them. They are for the most part synoptical classifications, not merely artificial keys. In all cases the contrasting characters are carefully ranged, that is to say, they begin in the same column.

ORDER APTERYGIFORMES

KIWIS

Bill, long, nostrils at tip. Wings rudimentary. No distinct quills or tail feathers. Aftershaft absent. Hind toe present. Comprises a single family.

FAMILY APTERYGIDAE. KIWIS

The smallest of the Ratitae. Bill long and slender, little curved, base covered with a hard cere; tip projecting over lower mandible; nostrils small and linear, placed on each side at tip. Long hairs at base of bill. Wings covered with feathers. Tail not apparent. Tarsi stout, equal to middle toe; hind toe very short; claws strong.

Includes the genus Apteryx in New Zealand, and there has been referred to this family a metatarsus from the Pliocene of Queensland and named by De Vis, Metapteryx. Interest is added to this specimen by the presence in the Post-Tertiary beds of Queensland of a portion of a femur belonging to the moa genus Pachyornis.

Genus Apteryx

The characters given under the order and family are those of this genus. The Kiwis stand apart from all other living birds in the nostrils being placed at the tip of the bill, the rudimentary wings and the absence of a tail. They are further remarkable for the relatively enormous egg which they lay. The structure of the egg shell agrees with that of Carinate birds in the pore canals being unbranched.

The anatomy and osteology of the Kiwis has been exhaustively studied and the general conclusions are that they are descended from birds capable of flight; and that both the Ratite birds, which include the Moas and Kiwis, and the Carinate birds are derived from an early group of flying birds. An intensive study of bird structure and development, however, convinced P. R. Lowe that Ratite birds have never advanced to the stage of having wings capable of flight. The characters which constitute the general make-up of Ratite birds, states Lowe, "represent primitive characters indicative of an early phase in the evolution of the true bird".

Key to the Species and Subspecies

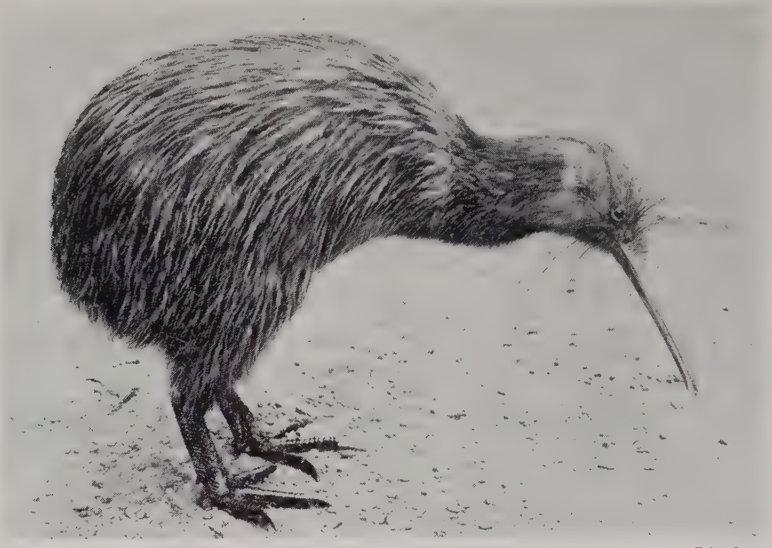
- Plumage streaked with black.
  - Rufous. Feathers harsh to touch. North Island .... *A. a. mantelli*
  - Greyish. Feathers soft to touch.
    - Smaller. Bill 95-140 mm. South Island .... *A. a. australis*
    - Larger. Bill 120-200 mm. Stewart Island .... *A. a. lawryi*
- Plumage barred with brownish black.
  - Rufous. Larger. Bill to 135 mm. .... *A. haasti*
  - Greyish. Smaller. Bill to 90 mm. .... *A. oweni*

References.—Shaw, Nat. Misc. 24, pl. 1057, 1813 (*Apteryx*, type *A. australis* Shaw). Lydekker, Cat. Foss. Birds Br. Mus., 218, 1891 (*Pseudapteryx*, type *P. gracilis* Lyd.). Parker, Phil, Trans. Roy. Soc., 182, 25, 1891 (anatomy).

North Island Kiwi

Apteryx australis mantelli

In 1827 the North Island Kiwi was met with at Tolaga Bay, in the East Cape district by d'Urville who, as commander of the French exploring expedition, was then visiting New Zealand in the *Astrolabe*. This is the first mention of this species that I have traced. Shortly after this, in 1834, the Reverend W. Yate stated that this Kiwi was rare but found in the greatest numbers at Mount Hikurangi, which is inland from



C. J. Lindsay

NORTH ISLAND KIWI

Tolaga Bay. The naturalists of the French expedition that visited New Zealand in 1839 in the *Astrolabe* and *Zelee,* Hombron and Jacquinot, also obtained the North Island Kiwi and published a coloured plate of it in their report on the birds collected by the expedition. Hitherto it had not been distinguished from the South Island Kiwi but in December 1850, Mr. Bartlett showed a series of specimens at a meeting of the Zoological Society of London and comparing them with a specimen taken at Dusky Sound, pointed out several differences. He accordingly described the North Island specimens as a new species naming it *Apteryx mantelli.* A live specimen, presented to the Zoological Society by Lieutenant Governor Eyre in 1851, lived for some years and laid several eggs.

Adult Male. Head and neck blackish grey, greyish towards the base of the bill; upper surface dark rufous streaked with black; lower breast and abdomen pale greyish brown. Bill light horn colour. Iris black. Feet brown. Bill 120-140, tarsus 58-70, mid toe 60-76 mm. The female is larger. Bill 130-180, tarsus 65-90, mid toe 70-86 mm. There is a considerable amount of variation in the coloration of this species some specimens having the black preponderating on the upper surface; in others rufous brown predominates. *Nestling.* Upper surface black streaked with brown mainly on the shafts and bases of the feathers. On the head, breast and abdomen it is greyer. Bill white, pinkish at the base. Feet grey, claws black. A nestling from Waitara has the upper surface reddish brown with inconspicuous streaks of black, due to the outer parts of the barbs being this colour. Head and under surface grey tinged with reddish brown, except the chin which is grey.

Colour Varieties. Pure white examples of the North Island Kiwi are occasionally observed. Buller records that out of 300 birds taken by Maoris in the Kaimanawa Ranges five were albinos. There is an albino from Taupo in the Australian Museum, one from Mokai in the Auckland Museum and a third from Eltham in the Dominion Museum. A live one from Taupo was released on Little Barrier Island in 1913. More rarely reported are individuals with red plumage. These were known to the Maori as Kiwi-kura. A red Kiwi from the Pirongia Ranges is described by Buller as having dull brick red plumage.

Eggs. Clutch one to three, elliptical, with blunt ends, white, smooth, 116 x 71 mm. Raglan. 120.5 x 76.5, 122 x 81 mm. Whangarei, same clutch. 135 x 82.5 mm. Whangaroa.

Status. In accordance with modern ideas the North Island Kiwi is classed as one of the three subspecies that make up the species *australis.* It is a well marked subspecies with a separate area of distribution and has usually been rated as a distinct species. It differs from the southern subspecies, *australis* and *lawryi,* in its smaller size, darker and more rufous colour, scutellated tarsus, and long straggling hairs on the face. The feathers of the upper surface are harsh to the touch due to their having lengthened and stiffened points.

Distribution. North Island. Formerly abundant, now less frequently found though existing in considerable numbers in the more extensive forest areas north of Manawatu Gorge. I have not come across any records of this species from the Tararua Range. Within the last five years it has been reported in several localities north of Auckland, at Mamaku, Huiarau Range, Waikaremoana and inland from Patea.

Between 1910 and 1940 this species was transferred to Kapiti Island and Little Barrier Island. In both of these sanctuaries it has increased considerably in numbers. It was reported to be present on Little Barrier Island in 1862 and again, by Reischek, in 1887, but none were thought to be on the island when the transfer from the mainland took place.

Habitat. Dense damp forests form the natural haunts of the Kiwi. Only in the soft ground and rotting leaves and logs of such places is its long sensitive bill adapted for obtaining its food. It hides in the daytime in burrows and hollow logs but at night becomes very active. It sleeps soundly placing its bill beneath the feathers of the side of its body in the manner that other birds tuck their bills under their wings. Although the feathers of the Kiwi are for the most part uniformly distributed over the surface of its body there is a bare space on each side and it is along one of these that the Kiwi rests its bill when sleeping.

Food. Worms, insects and their larvae, especially large grubs, and berries form the principal food of the Kiwi. It will readily eat our introduced vegetables such as peas, cabbages and vegetable marrow. Normally Kiwis do not drink, but, according to Robson, when they do the base of the bill is put under the water, the head then tilted back and the water runs down the throat. Apparently to assist digestion the Kiwi swallows pebbles. It extracts grubs from rotten logs and probes in soft ground for worms. The tip of the upper mandible overlaps the under one and thus protects the opening of the bill when being pushed through the soil. Scent more than sight seems to be used for locating its food. The method employed by a Kiwi captured north of Auckland, for extracting worms is thus described by Haeusler: "In searching for earth worms they showed a considerable degree of ingenuity. The hunt opened with the usual tapping. When by this means the bird discovered the burrow of one of these worms it set to work at once enlarging the opening, using its bill as a workman uses a crowbar. When it had formed a funnel-like depression, it inserted its bill and took a good hold of the worm. With a steady pull it often succeeded in bringing its victim to the surface. When it was not able to do so, it ceased pulling, as continuing to do so would have resulted in tearing the worm and losing the greater part, and leaning well back remained in the same position, waiting, without the faintest movement of any part of its body, until the worm, tired out by its exertion, momentarily relaxed its hold. Then with another steady pull generally drew it out of its burrow."

Voice. The cry of the Kiwi is a short shrill whistle generally uttered late in the evening. From this cry the Maori name Kiwi is derived.

Nesting. The Kiwi nests in holes beneath the roots of trees or in steep banks. The eggs are laid between July and February and the male alone performs the duty of incubation. One egg is the usual number laid, but nests with two eggs are frequent, and according to Cheeseman, three have been found in a nest. At Mohaka a nest made of manuka twigs, grass and feathers was found in a hole in the ground.

The breeding in captivity of the North Island Kiwi by Mr. F. D. Robson on the Hawke's Bay Acclimatization Society's game farm at Greenmeadows, near Napier, has resulted in some valuable information being obtained regarding the nesting habits and the chicks. What follows is taken from Robson's account. The male bird was captured about 1932 when it was thought to be five years old. The female was caught in November, 1938, when it was about two months old.

The first egg was laid on June 22nd, 1943, when the female was four years and nine months old though not full grown. Other eggs followed on July 3rd, August 1st and September 20th, or four in one year and all infertile. In subsequent years to 1947 three, two, two, and four eggs were laid in a year and four young hatched. The earliest date of laying was June 13th and the latest October 13th, both these extremes being in 1947.

The male does all the nest building though when burrowing the female helps. She sat on the egg for three days then the male took over for the rest of the period of incubation. The male sometimes does not leave the egg to take food for a week at a time. Each time he brings back twigs and straw for the nest and later lines it with feathers from his breast. The regular incubation period is 75 days though the first egg generally takes 77 days because the female starts sitting on the cold egg. In one case incubation took 80 days because the male bird left it too frequently. When the male has only one egg he keeps it longways between his legs; the second egg he keeps nearer his neck, and when there are three eggs he arranges them in a row, end to end or side by side.

When hatching the chick breaks off pieces of the shell until there is a hole about an inch across. He then gets a claw into the opening and breaks the shell away. The beak, as in the case of all other birds, is under the wing when the chick is breaking the egg. The male Kiwi gets rid of the egg shell by eating it.

Nestling. Robson records that when hatched the chick weighs about half a pound. Its eyes are open and its feathers are covered with a kind of slime. It takes four or five days for the slime to flake away and show the feathers. It is unable to hold its own weight on its legs until the fourth day and it does not go out of its nest for food until the sixth day. The first food is worms for which it starts probing the ground immediately. The young chick always stays with the male parent. Its call at first is a clicking sound, the adult call not being made until the chick is about a year old.

Maori. By the Maori the Kiwi was used for food and its feathers were much valued for making cloaks. It was caught at night by imitating its cry, or in the daytime by the use of dogs which found its burrows. The hunters then came up and dug out the birds. A Kiwi cloak is known as a Kahu-Kiwi, and is made by weaving the feathers into a base of flax-fibre. Such feather cloaks were highly valued and often the white feathers of albino birds were used for borders or stripes.

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South Island Kiwi. Tokoeka. Rowi

Apteryx australis australis

The first Kiwi skin to be forwarded to Europe belonged to this species and was obtained by Captain Barclay of the ship *Providence* about 1813. It found its way to Lord Derby's Museum and was described by Dr. Shaw under its present name *Apteryx australis.* So strange did the description seem that for a long time the very existence of the species was not credited and the specimen had to be produced to convince doubting minds that it was possible for such a strange bird to exist. The specimen was obtained at Dusky Sound, as likewise was the next one of this species to be taken, namely a bird collected by Mantell and shown at a meeting of the Zoological Society in 1850 when Bartlett defined his new species from the North Island. Two other specimens found their way to Europe, one to Leiden and another to Vienna and up to 1862 these four were all that were known. Then Hector who was conducting geological explorations in the south-west of Otago discovered the species in plenty from Milford Sound and Lake Te Anau south to Preservation Inlet.

Adult Male. Plumage soft to the touch, the shafts of the feathers not projecting beyond the barbs. Greyish brown, streaked longitudinally with black, the feathers slightly tinged with rufous near the tip. Head with less conspicuous streaking. Bill whitish horn. Feet flesh white, claws white. Bill 110-125, tarsus 60-80, mid toe 80-90 mm. The female is larger, bill 150-170, tarsus 70-80, mid toe 85-95 mm. *Nestling.* Covered with extremely soft plumage; head and hind neck dark grey; remainder of plumage greyish brown, lighter on the under surface; each feather with a narrow streak of fulvous. Bill light horn colour. Feet light brown. (Buller). *Colour Varieties.* A partial albino with white on the crown, sides of head, throat, foreneck and front of thighs is in the Canterbury Museum.

Eggs. Clutch one or two, elliptical, with blunt ends, white, smooth, 119.6 x 74 mm. Te Anau. 126 x 80.5, 127 x 82.5 mm. South Westland.

Status. The South Island Kiwi is intermediate in size between the smaller North Island and the larger Stewart Island subspecies. It is nearer the Stewart Island Kiwi in size, in its light coloration and in the feathers not having the shafts projecting beyond the barbs.

Distribution. South Island. In fair numbers in South Westland and Fiordland, rare farther to the north but seen in Marlborough Sounds in 1931. It is known to be in Milford, Caswell, Chalky and Dusky Sounds. In 1873 it was present in the forest bordering Otago Harbour. Transferred to Kapiti Island.

Habitat. Although the damp forests of the rainy districts of the South Island are the usual stations for this bird, it makes excursions during the night into the tussock and scrub belt above the forests for the purpose of feeding, returning to the forests to hide during the day. The birds are usually found in pairs, Potts believing that they paired for life.

Food. The food of the South Island Kiwi includes earthworms, insects, seeds, berries and young shoots of plants. In the Lake Brunner district, in 1889, W. W. Smith described their feeding habits in these words: "They generally live in pairs, and during the night visit the beds of Sphagnum moss, probing carefully through it with their long sensitive bill in search of minute larvae, chrysalides, and worms. They affect the beds of leaf-mould, and probe vigorously through it procuring the large worms existing in the mould. They ramble through the night among the dense beds of ferns, consuming nocturnal insects."

Voice. Henry, who lived among these birds for several years, describes the voice of the male as a high-pitched scream with a tremble and a sudden drop of several notes at the end of each call, which may be about two seconds and is repeated five or six times. The call of the female is similar but in a lower and hoarser tone somewhat like "ro-ar ro-ar" with both syllables accented.

Nesting. The caretaker of Resolution Island bird sanctuary in Dusky Sound, R. Henry, has put on record much interesting information about the breeding habits of the South Island Kiwi. He says that they nest in holes with a single entrance under roots of trees in the driest places they can find. The nest consists of a few handfuls of dry fern leaves and scrub. The male, Henry thinks, takes entire charge of the egg during incubation. He never found a female bird on an egg. On a few occasions he found the female bird in the burrow with the male when sitting on the egg. Reischek, who lived in Dusky Sound before Henry, gives a similar account stating also that the Kiwi lays in October. Henry found eggs in July and November and suggests that the Kiwi may lay twice in a year. Potts states that the breeding season extends from October to February. Potts says further that usually "two eggs are laid on which the old birds rather lie than sit. They squat opposite each other with their legs bent under them, each with its head tucked under the scanty apology for a wing. If there are young in the hole they assume a similar position on either side of a young bird."

References.—Shaw, Nat. Misc. 24, pl. 1057, 1813 (*Apteryx australis,* Dusky Sound). Buller, Birds N.Z., 365 ,1873; 2nd ed. 2, 322, 1888; Suppl. 1, 11, 1905. Henry, Trans. N.Z. Inst. 30, 288, 1898. Guthrie-Smith, Mutton Birds, 68, 1914. Rothschild, Nov. Zool. 6, 362, 1899. Owen, Extinct Birds N.Z. 1, 1879 (anatomy).

Stewart Island Kiwi

Apteryx australis lawryi

In 1890 Sir Walter Buller received a specimen of a large Kiwi taken on Stewart Island and exhibited the skin at a meeting of the Wellington Philosophical Society. This is the earliest record I can find of a Kiwi having been collected on Stewart Island. Three years later a specimen was sent to Rothschild who made it the basis of a new species, *Apteryx lawryi.* In 1911 Guthrie-Smith made a study of the nesting habits of this Kiwi and gave an account of them in his book *Mutton Birds and other Birds.*

Adult Male. Head greyish brown lightly streaked with black. Back heavily striped with rufous brown and black. Under surface grey streaked with brown, the abdomen paler. Bill slaty, culmen black. Feet dark bluish grey, claws paler. Bill 130-154, tarsus 70-85, mid toe 80-90 mm. The female is larger, bill 160-206, tarsus 75-100, mid toe 75-95 mm. *Nestling.* Feathered when hatched. Head and under surface grey, the abdomen tinged with light rufous. Upper surface brown tinged with rufous and streaked with black. Guthrie-Smith describes the bill of a live chick as ivory white tinged with flesh at the base. Feet white, claws pale lead colour. *Colour Variety.* Buller records having received a Kiwi-Kura or reddish variety of this subspecies similar to that occurring in the North Island Kiwi.

Eggs. Clutch two, elliptical, greenish white, 130 x 79, 133 x 81, 137 x 83 mm.

Status. Differs from *A. a. australis* in its larger size and more rufous colour. It is nearer to the typical subspecies of the South Island than to the North Island Kiwi.

Distribution. Stewart Island. Plentiful from north arm of Paterson Inlet southwards. According to R. H. Traill it has increased very much in numbers during the past few decades.

Habitat. The Stewart Island Kiwi is found in forest from sea level to the upper limits of the mountain scrub. It breeds at the lower levels. Investigating the habits of the Kiwi in Stewart Island, Guthrie-Smith discovered besides breeding burrows, lodges which are believed to be permanent homes of the Kiwi families. "Of the Kiwi lodges we obtained two," states Guthrie-Smith. "One was in a steep sand bank on the forest's edge with three easily and well beaten divergent pads. The other lay beneath the bole and torn up roots of a long-fallen rimu. Probing with a stick revealed a length of seven or eight feet, wide side passages and ramifications. In each we could feel a bird."

Nesting. Guthrie-Smith found the Kiwi nesting in forest in Rakiahua Valley in October. Four burrows were examined. One contained an adult and a chick, one a sitting bird and egg, the third had just been vacated and in the debris were pieces of egg shell, the fourth burrow was empty. The entrances of the burrows and of the lodges faced north or west thus opening to the warmth. The breeding burrows were quite shallow, says Guthrie-Smith, and their entrance tunnels short. That of the Kiwi and chick was two feet six inches in length, that of the Kiwi and egg one foot nine inches. The longer burrow was tunnelled into slightly rising ground beneath the bole of a living kamahi tree. Through a tangle of gnarled roots there was an alternate entrance to the burrow. The height of the breeding chamber was about eighteen inches and in it the birds crouched with their backs to the light. "The actual nest was quite a considerable structure, the base composed of twigs and sticks of an inch round, and lined with fern fronds and leaves. . . ."

References.—Rothschild, Bull. B.O.C., 1, 61, 1893 (*A. lawryi,* Stewart Id.). Buller, Suppl. Birds N.Z., 1, 1, 1905.

Little Grey Kiwi. Kiwi-pukupuku

Apteryx oweni

The Little Grey Kiwi was first described in 1847 by Gould from a specimen obtained by F. Strange. The locality is not recorded but probably it came from Nelson or Marlborough. In 1873 Potts published an account of its habits and about this time specimens were collected in South Westland and sent to England. At that time the species was common on the western side of the South Island and in Marlborough. Then a regular trade in skins sprang up and large numbers were collected for European museums. Further, with the advance of European settlement considerable areas of forest were cleared, birds were killed by prospectors and others for food and their attendant dogs and cats took their toll. Now the species is rare in Marlborough and northern Nelson but found in moderate numbers further south.

Kapiti *A. S. Wilkinson*

LITTLE GREY KIWI

Adult. Head and neck yellowish grey; remainder of plumage light yellowish grey, mottled and irregularly transversely banded with blackish brown; under surface slightly paler. Bill flesh colour. Iris black. Feet whitish. Male: bill 75-97, tarsus 50-66, mid toe 60-64 mm. Female: bill 90-118, tarsus 58-66, mid toe 64-76 mm. The nestling is coloured similar to the adult. *Colour Varieties.* Several yellowish white specimens of the Little Grey Kiwi have been obtained from Martin's Bay and other localities, and partial albinos have also been found. Potts considered the albinos to be too frequent to be accidental and so gave them a specific name (*A. mollis*).

Eggs. Clutch one or two, elliptical, obtuse at both ends, white, smooth. 105.4 x 68 mm. Nelson. 106.6 x 69.4 mm. Dusky Sound. 109.4 x 72.4 mm. Martins Bay. 113 x 76 mm. West Coast.

Status. The Little Grey Kiwi is the smaller of the two species of spotted kiwis. As a species it varies considerably in size. Gould's type specimen was a small bird and probably came from Marlborough or Nelson where small birds are prevalent. On the western side of the Southern Alps a larger form is usual. If these size differences are constant and the areas of distribution of the two forms more or less separate there would be reason for considering the Little Grey Kiwi as consisting of two subspecies. More information, however, than is available at present is required to settle this point. The larger kind, which includes the white varieties, was named *Apteryx occidentalis* from a specimen obtained at Dusky Sound. Corresponding with its size the brown bands on the upper surface are wider. The general colour is darker in these southern birds.

Distribution. South Island: Marlborough, Nelson, Westland and Fiordland. Sea level to over 2,000 feet. Buller recorded a specimen as having been taken by Morgan Carkeek on the Tararua Range but the presence of the species in the North Island has not been confirmed. Transferred to Kapiti Island.

Habitat. The Little Grey Kiwi is a denizen of the dense wet forests. In the Sounds district in the summer time it feeds in the high open tussock country returning each night to the forest. In the forest it frequents those parts where the floor is mossy or where there are plenty of rotten logs. It hides by day and comes out at night to feed.

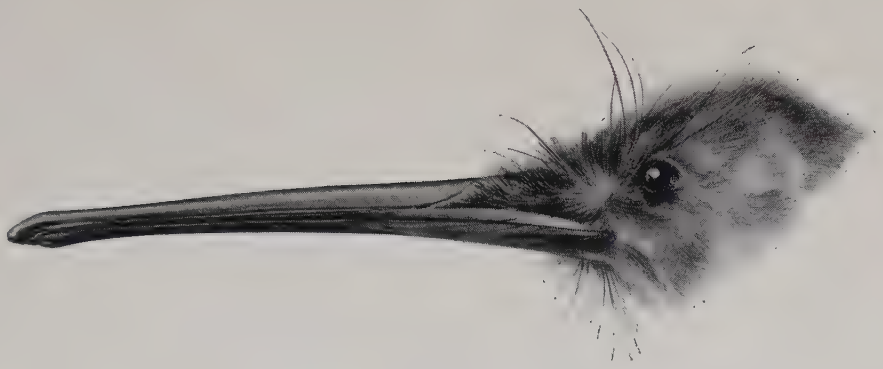
Food. Worms and insects are obtained in mossy forests and dead logs. Berries are also eaten, while stones and hard seeds are swallowed to assist trituration.

Voice. The call of the male is described as a shrill whistle and that of the female as less shrill. Potts stated that the cry was not heard till nightfall and that to him it sounded like "kvee kvee" repeated many times, and was answered by "kurr kurr".

Nesting. Reischek, writing from Dusky Sound, says that the Little Grey Kiwi goes about singly until pairing begins when both sexes call each other. Both parents build the nest of dry leaves and grass. After laying, the parents separate. The male incubates the egg and the chicks are soon left to look after themselves. Reischek found that the kiwi breeds at different times during the year. R. Henry, who was stationed on Resolution Island for some years, also said that the male bird performed all the work of incubation because he found the male's breast very bare at this time.

Potts gives a slightly different version of the nesting habits of the Little Grey Kiwi. He states that the breeding season extends over several months, eggs having been found during the greater part of the year. The nest is found beneath the roots of trees, in logs, or under rocks. The eggs, never more than two, are laid on the bare soil. Potts says that both parents share the work of incubation, adding that the pair "usually remain together during some months". Reischek and Henry had better opportunities for observing the Little Grey Kiwi than had Potts. One must conclude therefore that the male alone incubates the egg.

References.—Gould, Proc. Zool. Soc. 1847, p. 93 (*Apteryx owenii*); Trans. Zool Soc. 3, 379, col. pl. 1847. Rowley, Orn. Misc. 1, 20, col. pl. 1875. Potts, Trans. N..Z Inst. 5, pp. 188, 196, 1873 (*A. owenii, A. mollis*). Buller, Birds N.Z., 368, col. pl. 1873; 2nd ed., 2, 327, col. pl. 1888; Suppl. 1, pp. 19, 23, 1905 (*A. owenii, A. occidentalis*). Rothschild, Bull. Br. Orn. Club, 1, 61, 1893 (*A. oweni occidentalis*); Nov. Zool, 6, 383, 1899.



Lily A. Daff

LARGE GREY KIWI

Large Grey Kiwi. Roa

Apteryx haasti

Though many stories regarding a large Kiwi called by the Maori Roaroa, were current prior to 1871, it was not until that year that two specimens were received from Westland at the Canterbury Museum. Potts immediately recognised them as belonging to an undescribed species and named them in honour of Dr. Haast, curator of the Museum. One of the specimens was found far up the Okarito River and the other near Lake Mapourika both in dense forest. A third specimen was a year or two afterwards forwarded to the Canterbury Museum and in 1874 Mr. Bills obtained five in the mountains of the West Coast thirty miles up the Okarito River. These were forwarded to England and exhibited at a meeting of the Zoological Society.

Adult. Head and neck dark greyish brown, a dark patch below the eye; upper surface fulvous tinged with chestnut, mottled and irregularly transversely banded with brownish black; under parts grey mottled and irregularly transversely banded with dark brown. Bill light horn colour. Iris black. Feet dark brown. Male: bill 100-120, tarsus 72-82 mm. Female: bill 130-160, tarsus, 80-92, mid toe 90 mm. The *immature* is similar to the adult but the light bands on the upper surface are yellowish grey, the chestnut not being developed except the tips of the shafts and a barb each side. *Colour varieties.* In the Tring Museum are two partial albinos. One has greyish white patches on the head and scattered white feathers elsewhere, the other has a broad band of yellowish white on the under surface.

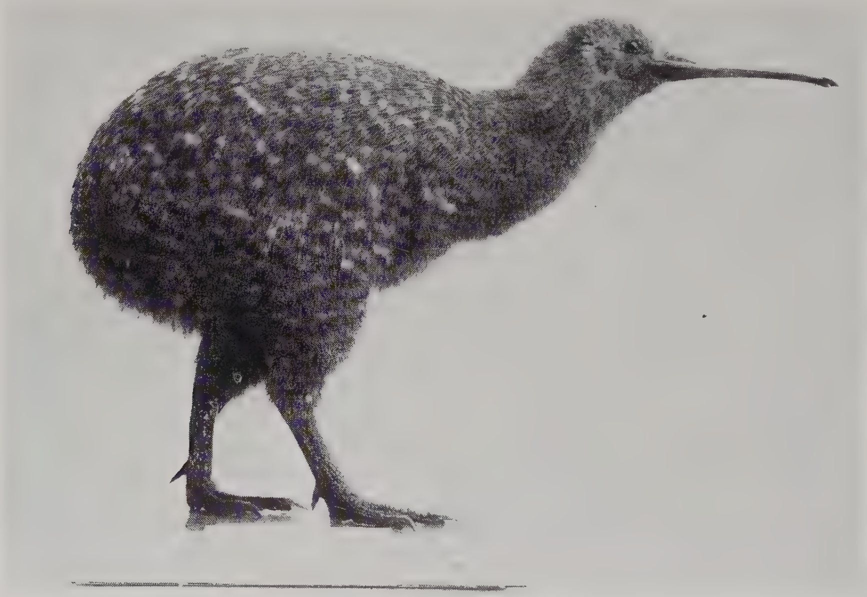
Eggs. Clutch one, elliptical, blunt at ends, pale greenish white, 128 x 85 mm. Dusky Sound. 130.2 x 79.4, 120.6 x 69.8 mm. Heaphy Range.

Status. Distinguished from *A. oweni* by its much larger size and by its more rufous upper surface.

Distribution. The western portion of the South Island from Tasman Bay to Foveaux Strait. Probably not uncommon in many localities. Specimens have been obtained from the Heaphy Range, Gouland Downs, Buller River, Rotomanu, Koiterangi, Okarito River, Jackson's Bay, Dusky Sound and, within the last ten years, from Ikumatua, Greymouth, Inangahua and reaching the eastern side at Lewis and Arthur Passes. Nineteen birds from the Gouland Downs were transferred to Little Barrier Island in 1915.

Nesting. Very little is known about the nesting habits of the Roa. C. Robinson made a trip to the Heaphy Range in 1892 and collected adults, chicks and eggs. The birds were found breeding on the north sides of wooded spurs with a sunny aspect. On December 20th a female bird with an egg was found under a tussock. The male was found nearby under another tussock. On January 12th two chicks were found, one in a hole among roots, the other running with the parents, and on January 26th an egg about to hatch was found. Other breeding birds were found in holes, or in hollow logs, or under limestone rock shelters.

References.—Potts, Trans. N.Z. Inst., 4, 204, 1872 (*Apteryx haasti,* Westland). Rowley, Orn. Misc., 1, 3, col. pl., 1875. Buller, Birds N.Z., 371, 1873; 2nd ed., 2, 230, 1888; Suppl., 1 25, col. pl., 1905. Rothschild, Nov. Zool., 6, 381, 1899.



C. J. Lindsay

LARGE GREY KIWI

ORDER SPHENISCIFORMES

PENGUINS

Wings modified into flippers adapted for swimming. Feathers reduced to small scale-like structures. Bones of the flippers and the rami of the lower mandible much flattened and expanded.

The southern oceans reaching as far north as southern Australia, north of New Zealand, Galapagos Islands, and South Africa.

FAMILY SPHENISCIDAE

The structure of the penguins is so uniform that only a single family need be recognised. Characters additional to those of ordinal value are: Bill stout, decurved at tip, covered with several horny plates. Tail composed of many narrow stiff feathers. Front toes united by web, hind toe united to tarsus. Young covered with down, helpless.

Key to New Zealand Genera

- Bill long, both mandibles curved down at tip .... *Aptenodytes*
- Bill short or moderate; upper mandible decurved at tip, lower mandible straight.
  - Bill with deep grooves.
    - A white band from eye to eye over crown .... *Pygoscelis*
    - Yellow superciliary band uniting behind .... *Megadyptes*
    - Yellow superciliary crests not uniting behind .... *Eudyptes*
  - Bill without conspicuous grooves ...... *Eudyptula*

Genus Aptenodytes

Bill long slender, both mandibles curved downwards towards the tip, the upper extending beyond the tip of the lower. A distinct groove between the culminicorn and latericorn. Flippers long and narrow. Tail moderate, of 20 feathers; upper tail coverts extending more than half-way to the tip.

The two species of penguin forming this genus are large birds easily distinguishable from all other penguins by the long downward curved and pointed bill and by the long narrow flippers. Both species have orange patches on the sides of the neck.

Both species are circumpolar in distribution, the Emperor Penguin being strictly Antarctic, while the King Penguin is Subantarctic, breeding on various islands in the Southern Ocean.

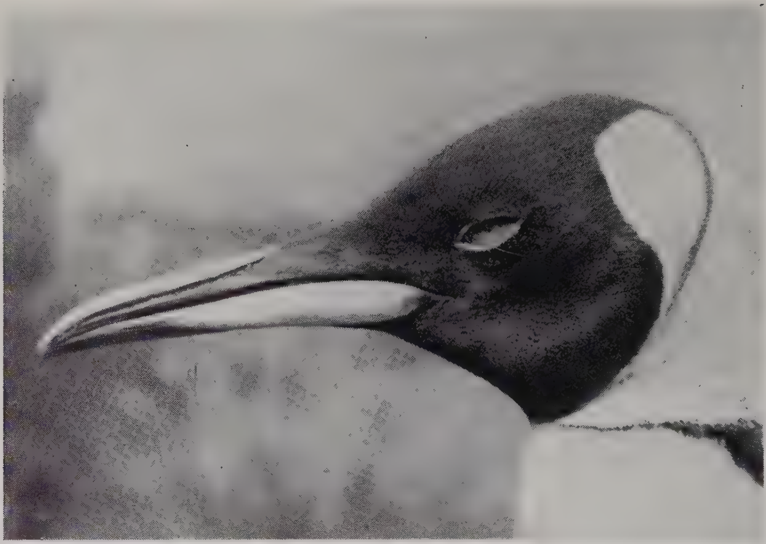
Reference.—Miller, Var. Subj. Nat. Hist. pl. 23, 1778 (*Aptenodytes,* type *A. patagonica* Mill.).

King Penguin

Aptenodytes patagonica

The first King Penguins brought to the notice of science were obtained at South Georgia and described by Miller in 1778. They were early known to sealers on Macquarie Island and specimens were collected and brought to England by G. Bennett in 1815. At that date there was a colony at the north end of the island, estimated by Bennett to be 30 or 40 acres in extent. The Russian explorer Bellingshausen in 1820 saw these penguins on Macquarie Island and noted that the egg was incubated on the feet of the standing bird which could hop along with the egg in position.

The King Penguin was for some years ruthlessly killed by sealers for its oil. This wholesale slaughter resulted in the destruction of the immense colony at the north end of the island which Bennett visited in 1815. The colony at Lusitania Bay was also considerably reduced in size. In 1894 A. Hamilton reported that the colony at the



Campbell Island *J. H. Sorensen*

KING PENGUIN

north end of the island had entirely disappeared but at Lusitania Bay the beach for over half a mile in length was occupied by King Penguins. In 1913, Ainsworth stated that in that locality existed the only remaining colony of the species including altogether about 6,000 birds. Such briefly is the history of the King Penguin on Macquarie Island, a history that unfortunately has many parallels in mammals, birds and reptiles. Indeed it appears to be the fate of all wild animals in which man is commercially interested.

Notwithstanding Bennett's early account of the King Penguins on Macquarie Island ornithologists were slow in admitting the species to the list of birds inhabiting New Zealand. Ellman included it in 1861 but Buller omitted it in 1873. It was safely established when Scott recorded the results of his visit to Macquarie Island in 1880.

Adult. Head and throat greenish black; a spatulate patch of deep golden yellow on either side of the head produced into a band down the sides of the neck; hind neck and upper surface pale blue, each feather with a dark centre; tail black. Upper part of foreneck deep golden yellow; a narrow black band extends on either side from the black of the throat crossing the yellow band and then margins the blue of the back as far as the flippers, widening out below; breast and abdomen silky white. Bill bluish black, the lower sides of the lower mandible except the tip, orange red. Iris brown. Feet black. Bill 85-100, flipper 300-352, tail 55-90, tarsus 45-54, mid toe 97-110 mm. *Immature.* Differs from the adult in the patches on the sides of the head and neck being pale greenish yellow, and only a tinge of yellow on the breast where later in life it becomes so rich; patch on top of head bluish grey with yellowish green tinge, extending down nape and posterior margins of yellow neck patches. Bill bluish black, base of lower mandible pale mauve. *Nestling.* Uniformly covered with smoky or chestnut-brown down. Gillespie records for South Georgian birds that the chick is hatched naked except for a few filaments of whitish down; the filaments gradually disappear and in about a week are replaced by brown down.

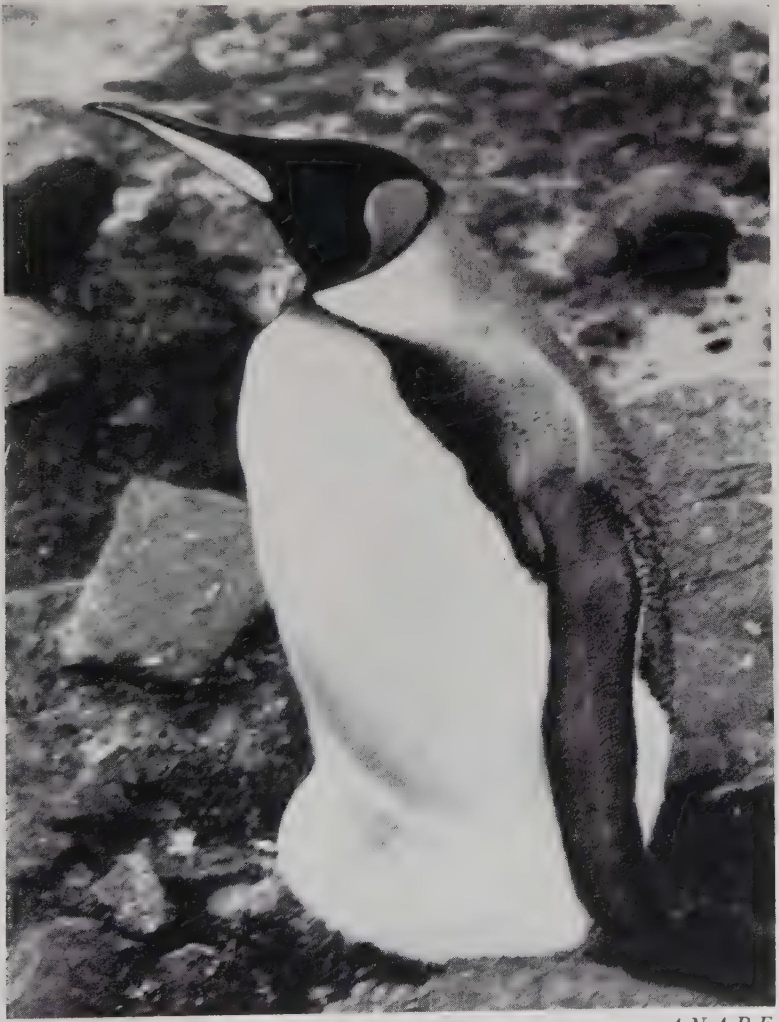
Eggs. Clutch one, pyriform, tapering suddenly to a blunt point, pale greenish white, chalky outside; surface roughened with small papillae. 102 x 76, 91 x 69.5, 106 x 75 mm. Macquarie Island.

Distribution. One breeding colony remains on Macquarie Island. Elsewhere stragglers have been observed at Moeraki (Otago), Auckland Harbour and at Stewart, Snares, Campbell and Antipodes Islands.

From Tierra del Fuego to the Falkland Islands, breeding on Staten Island and South Georgia. In the Indian Ocean breeding on Kerguelen, the Crozets, Heard Island and Marion Island. A straggler has been recorded in Tasmania.

Habitat. The King Penguin is a non-migratory species remaining at Macquarie Island throughout the year. Its quarters extend from the crown of the beach to the foot of the cliffs. A. Hamilton once marked a bird which belonged to a party of twenty occupying an open grassy place near his hut. With the exception of an occasional short absence for a swim this penguin and his friends were generally within a very short distance of the hut and always spent the night there.

Food. According to Wilson the food of the King Penguin consists mainly of crustaceans, fish and cephalopods.



Macquarie Island *A.N.A.R.E.*

KING PENGUIN

Nesting. An excellent account of the King Penguin has been published by A. Hamilton who visited Macquarie Island in 1894. The rookery then occupied an area of 30 or 40 acres at Lusitania Bay. Some of the birds were fighting with their neighbours, standing still, either in a puddle or on a wet slimy stone, but keeping their flippers and bill in constant action, their object apparently being to make each one keep its regulation distance, about one foot four inches, from the others. Subangular fragments of rock covered with slimy black mud cover the ground and the beautiful white breasts of the birds are filthy with the splashings. There is no nest, in fact the birds may move their eggs about during the period of incubation. The eggs are laid from December to February or March. Each is carefully carried on the feet being wedged in between the legs. Hamilton was informed that during incubation the males relieve the females about every two days. The young endeavour to get as far as possible under their parent which however seems to afford them little protection. The slopes on the beach in front of the breeding ground were apparently devoted to the bachelors.

Bennett, describing in 1834 the great rookery of King Penguins that then existed at the north end of Macquarie Island, stated that the birds were arranged in as compact a manner and in as regular ranks as a regiment of soldiers, and were classed with the greatest order, the young birds being in one situation, the moulting birds in another, the sitting hens in a third, the clean birds in a fourth, and so strictly did birds in similar condition congregate, that should a bird that was moulting intrude itself among those which were clean it was immediately ejected from among them.

Studying South Georgian King Penguins in the Edinburgh Zoological Gardens, Gillespie ascertained that the period of incubation averaged seven and a half weeks, the moulting of the downy covering of the chicks was completed when they were seven to nine months old, and the birds were not sexually mature until they were about five years old. A bird which has not moulted its first plumage is infertile.

References.—Miller, Var. Subj. Nat. Hist. pl. 23, 1778 (*Aptenodytes patagonica,* South Georgia). Buller, Birds N.Z., 2nd ed., 2, 306, 1888; Suppl. 1, 78, 1905. Mathews and Iredale, Man. Birds Austr., 1, 13, col. pl., 1921. Hamilton, Trans. N.Z. Inst. 27, 569, 1895. Wilson, Nat. Ant. Exp. Zool. II, Aves, 32, col. pl., 1907. Gillespie, Book King Penguins, 1932. Murphy, Ocean. Birds S. Amer., 1, 343, 1936. Falla, B.A.N.Z.A.R.E., (B), 2, 42, 1937.

GENUS PYGOSCELIS

Bill short or moderately long, the culminicorn divided by a groove from the latericorn which is not swollen and is narrow at the base. Tail long, of 12, 14 or 16 feathers.

This genus is allied to Megadyptes from which it differs in the narrower latericorn and in the greater amount of feathering at the base of the bill. There is no yellow superciliary band.

Pygoscelis comprises three species found in Antarctic and Subantarctic seas. The gentoo and adelie penguins are circumpolar, the ringed penguin (*P. antarctica*) has been met with only in the Atlantic quadrant.

Reference.—Wagler, Isis, 1832, p. 281 (*Pygoscelis,* type *Aptenodytes papua* Forst.).

Gentoo Penguin

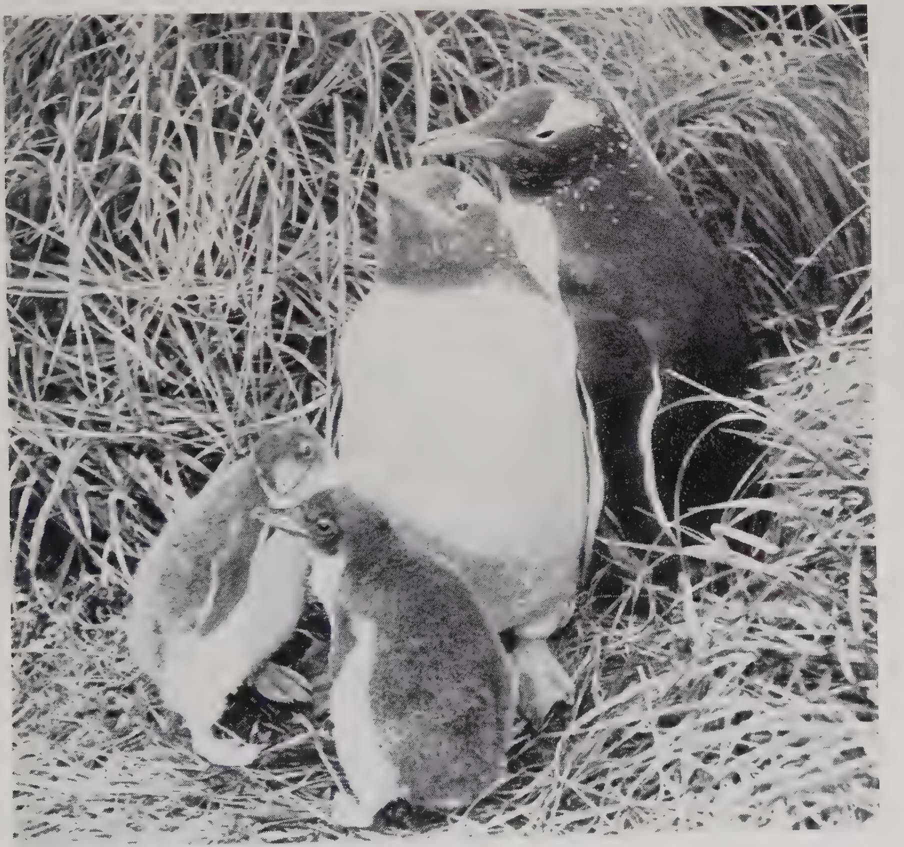
Pygoscelis papua

The Gentoo Penguin was first discovered at the Falkland Islands whence specimens were described by Forster in 1781. In the New Zealand region it was first collected by the American Exploring Expedition under Commander Wilkes at Macquarie Island where in 1840 the *Flying Fish,* one of the five ships of the expedition, called and landed a boat's crew.

Adult. Head and neck slaty black, with a white band extending from eye to eye across the head, narrow in the middle. White filoplumes scattered about the face and neck. Remainder of upper surface bluish-black; flippers margined behind with two rows of white feathers. Breast and abdomen white. Bill yellowish-orange, the culmen much darker. Iris brown. Feet orange yellow with black claws. Bill 50-56, flipper 240-260, tail 120-160, tarsus 26-30, mid toe 77-84 mm. *Immature*. Differs from the adult in having a smaller bill; chin and throat white mottled with greyish black. *Nestling*. When hatched covered with scant down, silver grey above, greyish white tinged with buff below; in a few days this is replaced by thick down, grey above except margins of flippers which are white, under surface white. The moulting of this second down begins when the chick is about eight weeks old. South Georgia. (Gibson-Hill.) Nestlings from Macquarie Island with feathers appearing are, according to Falla, sooty brown above, white below except the chin and throat which are ashy. Colour of bill and feet as in adult but paler.

Eggs. Clutch two; broadly elliptic, dark sea green inside, chalky white outside. Sixty-eight eggs from Macquarie Island measured by Falla: axis 63-71 (av. 67), diam. 53-60 (56.4) mm.

Distribution. Macquarie Island, breeding. The Antarctic and Subantarctic zones of Ocean waters, breeding on islands in both zones. Breeds at West Antarctic Archipelago, South Shetlands, South Orkneys, Staten Island, Falkland Islands, South Georgia; Prince Edward, Marion, Crozets, Kerguelen and Heard Islands in the South Indian Ocean. A single specimen has been taken in Tasmania. The birds breeding in the South Shetlands and West Antarctic Archi-



Macquarie Island *A.N.A.R.E.*

GENTOO PENGUIN

pelago have been separated as a subspecies, *P. p. ellsworthi,* by R. C. Murphy.

Habitat. The Gentoo Penguin, unlike most of the other New Zealand members of the family does not migrate but remains all the year round on Macquarie Island. The colonies which are small are found on mounds amongst the tussock or on hillsides near the sea.

Food. Fish, crustacea, squids.

Nesting. The breeding habits of the Gentoo Penguin on Macquarie Island have been briefly described by G. F. Ainsworth in Mawson's *Home of the Blizzard.* The nests are constructed of grass and other leaves and are congregated in small colonies among the tussock grass. The first eggs are laid about the middle of September. These birds are more timid than any other species of Penguin and leave their nests when anyone visits their breeding place. Blake, a member of the same expedition, records that chicks were observed on November 3rd.

Regarding his visit to Macquarie Island on December 2nd to 4th, 1930, Falla writes of the Gentoo Penguin: "Solitary nests were not uncommon, but small groups of about a dozen nests were most frequent. Three larger colonies were established on the Featherbed Terrace near Hasselborough Bay, in each about 100 well-grown chicks in down at the stage (about two months old) when streaky white feathers had begun to appear above the eye. There were not more than twenty adults in attendance on each of these groups during the day. Earlier stages of nesting, even to new nests, were represented by other birds here and there."

The habit of leaving chicks guarded by a limited number of adults during the daytime has been described for many of the islands where the Gentoo Penguin breeds. The following is extracted from Falla's account of Kerguelen, November 23rd, 1929, at Island Harbour. "Here the majority of birds, over 100, were young, still in down, but well grown. Only about 30 adult birds were ashore during the day, half of them engaged in the important task of looking after the crowds of irresponsible youngsters until the return of the rest of the adults in the evening, when feeding began. The system was in operation on all the islands visited, and the duties much the same everywhere, consisting of keeping the young in groups and rounding up strays at intervals. Many of the nurses were males, and had the appearance of being rather young birds. In practice the proportion of nurses to charges required for efficient supervision seemed to average one to seven, better results being achieved when three or more nurses joined forces and marshalled a proportionately large mob of chicks."

Gibson-Hill does not believe in the nurse theory. Writing of South Georgia he says: The adults seen with these groups of young birds have been described as guards, but they are probably merely resting. If any danger threatens the group, they usually scamper away more rapidly than the chicks. Richdale also doubts the guard theory which he thinks is discounted by the fact that the so-called guards are often young males.

References.—Forster, Comm. Gott., 3, 140, 1781 (*Aptenodytes papua,* Falkland Id.). Peale, U.S. Expl. Exped., Birds, 264, 1848 (*A. taeniata,* Macquarie Id.). Buller, Birds N.Z., 2nd ed., 2, 304, 1888. Murphy, Ocean. Birds S. Amer. 1, 367, 1936. Falla, B.A.N.Z.A.R.E., (B), 2, 54, 1937. Gibson-Hill, Wild Life, Aug. 1948.

Adelie Penguin

Pygoscelis adeliae

This fascinating Antarctic species is admitted to the New Zealand avifauna on the evidence of a bird captured by A. M. Gwynn on Macquarie Island on November 19th, 1950. The skin is preserved in the National Museum, Melbourne.

Adult. Top of head, cheeks and throat black, remainder of upper surface bluish black; flippers with a narrow white posterior border; tail black. Under surface below throat white, the flipper with a black terminal patch and outer margin. Bill brick red, tip and cutting edges black. Iris reddish brown, eyelids white. Feet pale flesh pink, claws brown, soles black. Bill, 33-46, flipper 180-196, tail 130-170, tarsus 29-34, mid toe 65-80 mm. *Immature* similar to adult but throat white, bill blackish, eyelids black. *Nestling* grey with dark head to sooty brown with darker head.

Eggs. Clutch two, subspherical, chalky, inner shell green, length 64-72, breadth 50-55 mm.

Distribution. Macquarie Island. One occurrence.

Antarctic Ocean, nesting on the coast all round the Antarctic continent, also on South Shetlands, South Orkneys and South Sandwich Islands; in non-breeding season migrating to the pack ice.

References.—Hombron and Jacquinot, Ann. Sci. Nat., (2), Zool., 16, 320, 1841 (*Catarrhactes adeliae,* Adelie Land). Murphy, Ocean. Birds S. Amer., 1, 386, 1936. Falla, B.A.N.Z.A.R.E., Ser. B, 2, 61, 1937. Gwynn, Emu, 53, 150, 1953.

Genus Megadyptes

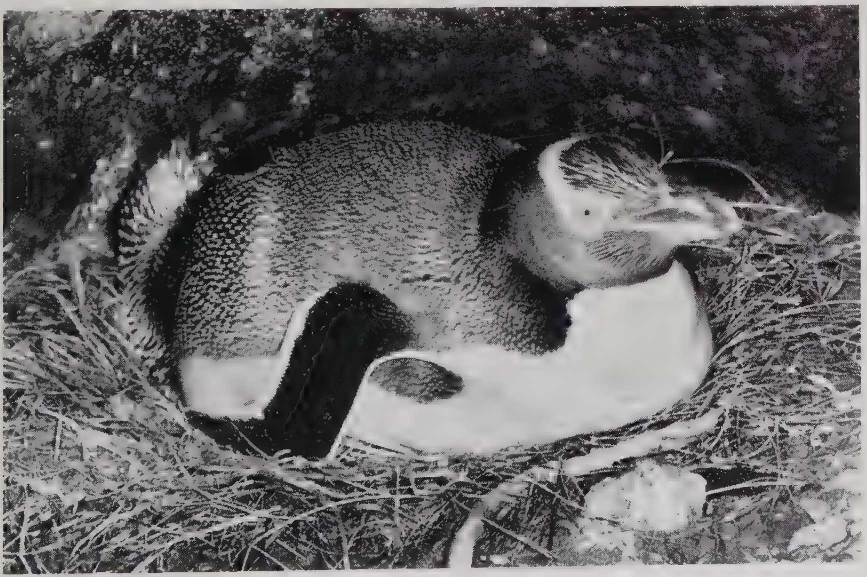
Bill long, moderately stout, lower mandible straight. Culminicorn divided by a groove from the latericorn which is not much swollen towards the base. Tail short, of 20 feathers, upper tail coverts short.

The long bill is characteristic and allies this genus to Pygoscelis, but the latericorn is broad and gives the bill the appearance of Eudyptula. The Yellow-eyed Penguin may readily be recognised by the yellow superciliary bands uniting behind. There is a single species confined to the New Zealand Region.

Reference.—Milne Edwards, Ann. Sci. Nat. (6), 9, 56, 1880 (*Megadyptes,* type *Catarrhactes antipodes* Hombr. and Jacq.).

Yellow-eyed Penguin. Hoiho
Megadyptes antipodes

Two exploring expeditions, the American Exploring Expedition and the French expedition commanded by Admiral d'Urville, visited the Auckland Islands in March, 1840. Both collected specimens of the Yellow-eyed Penguin. The American expedition's visit was from March 7th to 10th and the French from March 11th to 20th. The species was given its accepted specific name by Hombron and Jacquinot of the French expedition. The British Antarctic Expedition under Sir James Clark Ross in the ships *Erebus* and *Terror* obtained specimens at



Otago Peninsula *K. V. Bigwood*

YELLOW-EYED PENGUIN

both the Auckland and Campbell Islands in November and December, 1840. From the coast of New Zealand this penguin was first obtained by the British expedition in 1841. About 1885 it was discovered breeding on Otago Peninsula by P. Seymour and it was in this locality that its life history was worked out in detail over a period of eighteen years by L. E. Richdale.

Adult. Feathers of forehead and crown lengthened. Top and sides of head and extending below the bill, pale sulphur yellow, each feather with a central streak of glossy black; a band passing from the gape through the eyes and uniting behind the head clear sulphur yellow; upper surface slaty blue with a streak of black down the centre of each feather; flippers bluish black, the margins yellowish white, narrow in front but two feathers in width behind; tail bluish black. Throat and sides of neck fulvous brown; remainder of under surface white. Bill pale reddish brown, patch on upper mandible and most of lower mandible bluish white. Iris lemon yellow. Feet pinkish, claws and extremities of webs brown. Bill 50-58, flipper 200-223, tail 50-77, tarsus 30-40, mid toe 80-103 mm. *Juvenal.* Similar to the adult except that the white of the under surface extends to the chin and the clear yellow coronal band is absent, as is also the area of yellow feathers with black shafts on the head except a band from the bill to above and behind the eye. *Immature.* After the first moult which, according to Richdale, takes place between the ages of fourteen and eighteen months, the yellow crown and coronal band are developed. At first the band is not united behind. *Nestling* covered with brown down, the second down being a little lighter. Bill pinkish brown, iris yellowish grey, feet fleshy white, soles blackish. *Colour varieties.* A specimen from the Auckland Islands is white and grey all over. All black and blue pigments are absent but the yellow is as in normal birds. Buller notes that several specimens obtained on the Otago Peninsula had scattered black feathers among the white plumage of the under surface.

Eggs. Clutch two, broadly ovoid, pointed, white. 73 x 58, 77 x 57 mm. Otago Peninsula. 82 x 60, 88 x 58 mm. Otago Peninsula (Richdale). Richdale states that three year old birds lay heavier and wider eggs than two year olds, but not so heavy nor so wide as four year olds.

Distribution. South Island. Stewart, Codfish and other islands lying off Stewart Island, Auckland and Campbell Islands. Breeding on the islands and on the east coast of Otago from North Otago Head southwards, and straggling along the coast to Banks Peninsula and Cape Campbell, also in Foveaux Strait westward to the mouth of the Waiau River.

Ecology. The Yellow-eyed Penguin is a resident species, remaining in the vicinity of its breeding places throughout the winter. This was demonstrated by Richdale during his investigations on Otago Peninsula. He observed, too, that the birds come ashore for the night at all times of the year. The localities favoured by this species when ashore are scrub and forest covered slopes facing the sea both on the mainland and on islands. Richdale has noted them up to half a mile inland. They come ashore on both rocky and sandy beaches, and have been seen climbing a considerable distance up a loose sandy slope.

Where the Yellow-eyed Penguin has come in contact with European settlement it has suffered a considerable reduction in numbers. This is the case on Otago Peninsula where a good deal of the forest has been cleared with the consequent destruction of the penguin's breeding grounds. Added to this is the stupidity of irresponsible vandals who wantonly kill the birds and destroy their eggs.

Food. In the stomachs of Campbell Island birds Sorensen found cuttle-fish (or squid) beaks and remains of small silvery fish. For the birds on Otago Peninsula Richdale informs me that squid and small fish, yellow-eyed mullet and red cod, have been identified by him as part of the food of the yellow-eyed penguin.

Otago Peninsula *L. E. Richdale*

YELLOW-EYED PENGUIN FEEDING CHICK

Voice. According to Richdale's account of the types of behaviour, the Yellow-eyed Penguin has various call notes which apparently include a good proportion of yelling. In the "open yell" the bird lunges forward and "emits a yell at the top of its voice". In the "half trumpet" the bird "emits fairly loud continuous noises which are difficult to define". In the "full trumpet" the bird stands on its toes with the tarsi and legs erect, with the tail and body clear of the ground, "and the vast volume of trilling sound that issues forth is fantastically suggestive of the tremolo of giant crickets, and is musical to a degree". The "welcome" bears a close relationship to the "full trumpet" except that there is less of the pretty musical warbling and there is a preponderance of yelling.

Nesting. The nests of the Yellow-eyed Penguin are generally placed in forest or scrub near the shore as is the case on Stewart Island, at the Nuggets and on Otago Peninsula. At the Auckland Islands I observed these penguins breeding in holes on sloping ground cleared of scrub. On Codfish Island Dell gives low fern, among rocks, and in scrub or forest as the nesting sites. On Campbell Island Sorensen states that the nests are found in scrub and fern (*Polystichum vestitum*). The nests are placed singly, often under the shelter of a log, are sometimes two or three feet across, and consist of sticks and coarse grass. Richdale found that the male penguin begins to breed after the second moult, that is when it is in its third year, but the female may begin to breed after the first moult, when in its second year. According to the same observer the birds come ashore in August, and the main laying period is from the third week in September to the second week in October. The two eggs are laid at an interval of four days and take about six weeks to incubate. The extremes observed by Richdale were forty and fifty days. Hatching on Otago Peninsula takes place mainly between November 9th and 20th. On Campbell Island R. L. Oliver noted a newly hatched chick on November 29th. Richdale gives the age when the young leave the nest as 100 to 115 days by which time the down is completely gone. At the Auckland Islands on March 28th there were young in full plumage with a little down remaining on the head.

References.—Hombron and Jacquinot, Ann Sci. Nat. (2) 16, 320, 1841 (*Catarrhactes antipodes,* Auckland Id.). Peale, U.S. Expl. Exped., birds, 260, 1848 (*Aptenodytes flavilarvata,* Auckland Id.). Gray, Zool., Erebus and Terror, Birds, 17, col. pl., 1845. Buller, Birds N.Z., 346, 1873; 2nd ed., 2, 294, col. pl., 1888. Guthrie-Smith, Mutton Birds, 58, 1914. Falla, Rec. Auck. Mus., 1, 319, 1935. Mathews, Suppl. Birds Lord Howe-Norf. Is., 74, col. pl., 1936. Richdale, Emu, vols. 40, 44, 45, 46; Study of Penguins of Known Age, 1949; Sexual Behavior in Penguins, 1951; Ibis, 1954, 207.

GENUS EUDYPTES

Bill moderately long, stout; culminicorn divided by a deep groove from the latericorn which is swollen towards the base. Tail moderately long, composed of 14 to 16 feathers; upper tail coverts short.

Eudyptes is sharply marked off from all other penguins by the stout bill with deep grooves and swollen latericorn, and by the presence of yellow superciliary crests not uniting behind. The general colour is blue above and white below. In most of the species the throat and chin are black.

Six species found in Antarctic and cold temperate seas are included in the genus. *E. chrysocome* is circumpolar and there are three related species confined to the New Zealand region. A second section of the genus includes *E. schlegeli* from the south of New Zealand and *E. chrysolophus* from the South Atlantic and South Indian Oceans.

Key to the New Zealand Species of Eudyptes

Superciliary bands not uniting in front. Tail of 16 feathers.
  Feathers of superciliary bands greatly elongated ...... *E. chrysocome*
  Feathers of superciliary bands not greatly elongated
    Culmen. bowed
      Smaller. No white below bill .... *E. pachyrhynchus*
      Larger. White band below bill .... *E. robustus*
    Culmen parallel-sided .... *E. atratus*
Superciliary bands uniting in front. Tail of 14 feathers .... *E. schlegeli*

References.—Vieillot, Anal. Nouv. Orn., pp. 67, 70, 1816 (*Eudyptes,* type *Aptenodytes chrysocome,* Forst.).

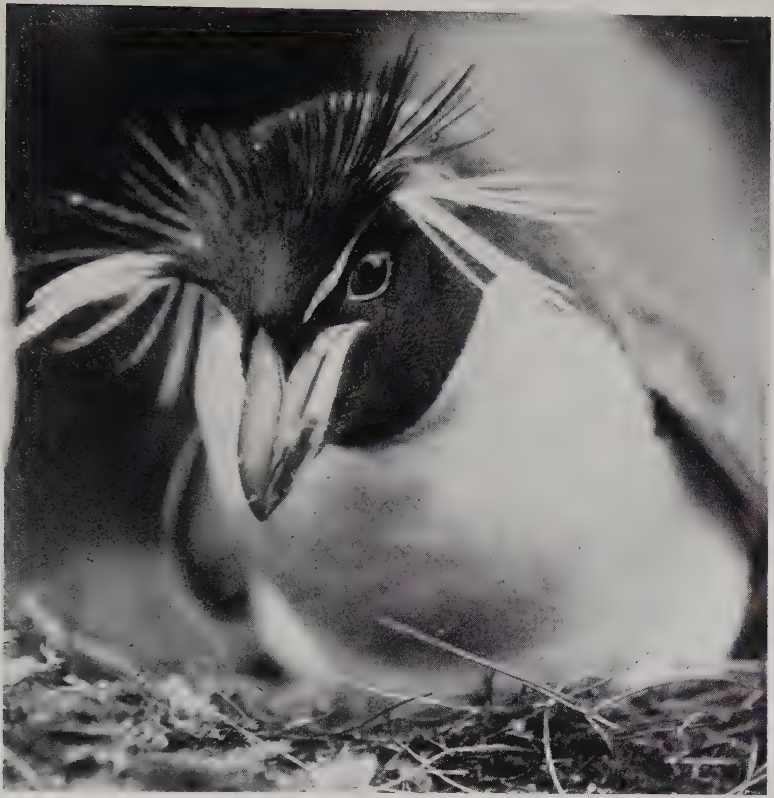
Rockhopper Penguin

Eudyptes chrysocome chrysocome

The Rockhopper Penguin was first discovered by Europeans in the Falkland Islands in the latter part of the eighteenth century. In 1871 J. R. Forster proposed the name *Aptenodytes chrysocome* for two specimens of crested penguins which he had seen. One was from Tasmania, the other from the Falkland Islands. The figure which accompanied the description was of the Falkland Islands specimen which should therefore be considered the type of the species.

In the New Zealand area the Rockhopper was first observed at Macquarie Island in 1840 by the United States Exploring Expedition. In 1874 it was obtained at Campbell Island by an officer of the French warship *Vire,* and a specimen presented to the Otago Museum. This was described by Professor F. W. Hutton under the name of *Eudyptes filholi.* As the Southern Islands became better known large breeding colonies were discovered on several of the groups.

Adult. Culminicorn viewed from above biconvex. Upper surface bluish black, each feather having a central streak of pale blue; sides of head and throat slaty black; flippers margined behind with one or two rows of white feathers. A golden yellow band begins behind each nostril at a little distance from the bill and passing over the eye spreads out into a tuft of drooping feathers. The feathers on the sides of the crown are also lengthened and mingle with the yellow plumes. Under surface below the throat silky white. Under surface of flipper with narrow bluish black broken band in front, narrow central band at tip and patch at base. Bill light brown, strip of purplish white skin from gape below man-



Campbell Island *J. H. Sorensen*

ROCKHOPPER PENGUIN

dible. Iris bright reddish brown. Feet pinkish with the claws and soles brown. Bill 40-51, flipper 162-190, tail 100-120, tarsus 25-34, mid toe 66-76 mm. New Zealand Subantarctic Islands. *Immature.* Differs from the adult in having the chin and throat ashy white and the superciliary crests indicated by yellowish lines. Bill brown with bluish-white patch on sides of mandible. *Nestling.* First down, sooty black above, lighter underneath. Second down, head and upper surface dark greyish brown, remainder of lower surface white. Bill dark brown. Iris dark greyish brown. Feet pinkish, soles darker.

Eggs. Clutch two, white or greenish white, broadly elliptic or ovoid, smooth, pitted, variable in size. 61.5 x 47, 65.5 x 56.5, 70.8 x 52.4 Macquarie Island. 63.4 x 45, 71.6 x 52.5 mm. Campbell Island.

Status. The Rockhopper Penguin can be distinguished from its allies by its red eyes, and drooping crests, which begin in the angles between the culminicorn and latericorn but a little distance from both. The culmen is like that in *E. pachyrhynchus* and thus differs from the parallel-sided culmen in *E. atratus.*

Save for the northern parts of its range, there are no differences in colour or size among Rockhoppers on which to base subspecies. Rockhoppers from Tristan da Cunha, Gough, St. Paul and Amsterdam may be separated as a subspecies, *E. c. moseleyi.*

Distribution. Breeding in large numbers in the Auckland (Disappointment), Campbell, Antipodes, Bounty and Macquarie Islands. Stragglers have occurred on the New Zealand coast at Akaroa and other localities on the coast of Canterbury, Otago Peninsula and east coast of Otago, Preservation Inlet and the Snares.

With the exception of Heard Island in the Antarctic zone, all the breeding places of the Rockhopper come within the Subantarctic zone, ranging from its southern border at Kerguelen and Macquarie Islands to its northern boundary at Tristan da Cunha, St. Paul and Amsterdam Islands. The breeding islands are: Diego Ramirez, Tierra del Fuego, Falklands, Tristan da Cunha, Gough, Prince Edward, Marion, Crozets, Kerguelen, Heard, St. Paul, Amsterdam, and the Subantarctic Islands of New Zealand. The species straggles into the Subtropical zone in Cape Colony, Western Australia, South Australia, Victoria, Tasmania and New Zealand.

Habits. Like its relatives, the Rockhopper is in its most natural element when in the water. It spends the winter at sea, only coming to land for the purpose of breeding. Ainsworth states that on Macquarie Island the Rockhoppers come and go with remarkable regularity, being first seen about the middle of October and leaving during the first week in May.

An interesting piece of evidence proving the length of time penguins remain continuously at sea is afforded by a specimen, probably belonging to this species, described by Buller, in which the toes supported a number of barnacles some, according to Buller's drawing, being about an inch in length.

On land the Rockhopper progresses by hopping and, if the surface be steep, helping itself along with its bill and flippers. In this manner it scrambles up the steep rocky face at Antipodes Island through a colony of Erect-crested Penguins to its own breeding ground high up the slope. It does not go far from the water's edge.

On Campbell Island, according to R. L. Oliver, moulting of nestlings in down, yearling birds and adults mostly takes place in February, though yearlings and adults are found moulting through March.

Food. Crustacea and fish have been taken from the stomachs of Rockhopper Penguins. Ainsworth states that the food brought by the parents for the young is mostly crustaceans.

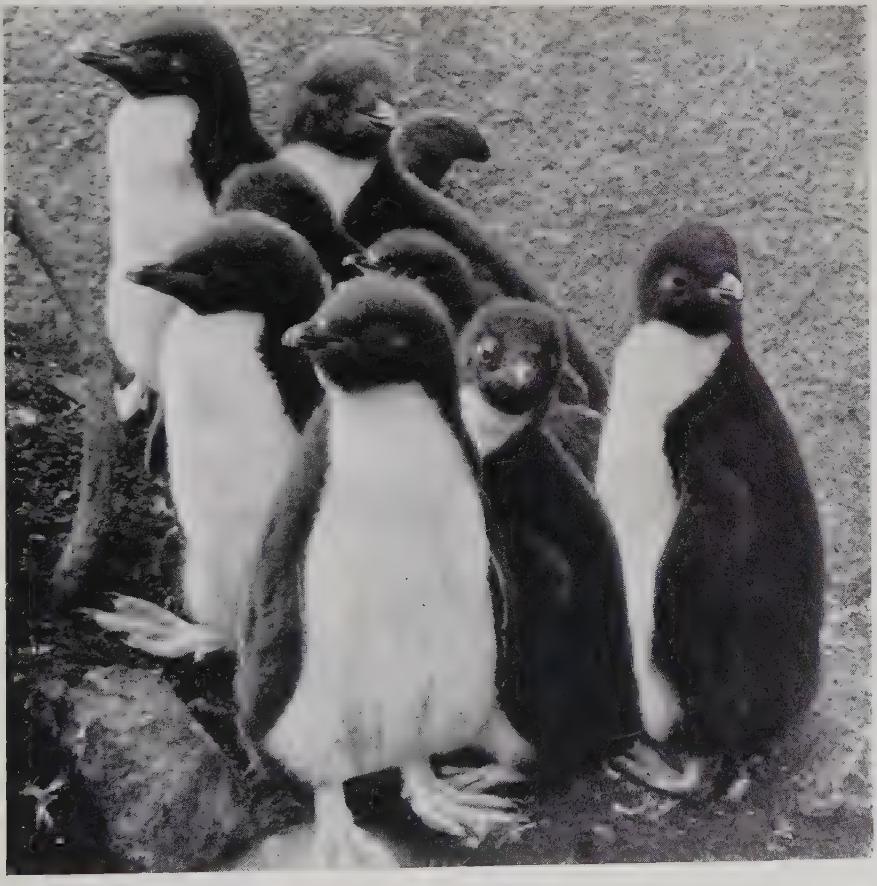
Nesting. The Rockhopper is very regular in its habits and, like some of the shearwaters, arrives from the sea almost on the same date each year. About 25 days afterwards most of the eggs are laid. According to R. L. Oliver the birds arrive at Campbell Island about the middle of October. One colony is recorded as being in full strength on October 17th. Eggs were common on November 10th, most nests with one egg, some with two. On December 29th most birds were sitting on one chick, a few had two.

J. H. Sorensen has published some interesting information on the nesting habits of the Rockhopper on Campbell Island. "Several large breeding colonies exist all round the island, but the one below Mt. Paris on the southern coast must be one of the largest known of this penguin. Seven birds to the square yard was a fair average and this gave the astonishing figure of two and a half million birds in the colony. . . . The main colony was situated among the tumble of rocks of all sizes and shapes with the patches of tussock and fern almost trampled right out. Only in crevices among the rocks could various small plants obtain a hold. The ground occupied by the penguins was churned to mud, ankle deep, and saturated with moisture and guano. . . . In such positions and surroundings the Rockhoppers were nesting, but few of the nests were worthy of the name, most being merely depressions in the mud and stones and not much drier—and certainly no cleaner—than the filth surrounding them. . . . Two eggs is the usual clutch and they soon get so liberal a coating of mud all over them as to be almost indistinguishable from the stones about the nest. . . . The mated pairs of these little penguins are very devoted and bitterly resent the intrusion of another bird within the immediate vicinity of their nest. The intruder is set upon with vigour and, as any attempt at retaliation only brings him within range of other families, a hasty retreat has to be made. Often in such retreat he runs foul of others, is knocked down, or slips over a ledge before he manages to gain a respite in an unoccupied area."

On the east side of Antipodes Island there is a large breeding colony high up on a talus slope composed of large boulders. The lower slopes are occupied by the Erect-crested Penguin. At the time of my visit in early April the young were in their first plumage and the adults, many moulting, were standing about in thousands on the breeding ground. By this time the nests were much trodden down. They appeared, however, never to have been more than shallow hollows in the mud and dung collected among the rocks. Feathers from the moulting birds also formed an ingredient of the surface.

It was observed by members of the Antipodes Island expedition in November, 1950, that the Rockhopper lays two eggs of which the first is not incubated. The second egg is incubated. The skuas try to take the second egg. Both R. L. Oliver and J. H. Sorensen noted some nests with two chicks on Campbell Island.

At Macquarie Island, according to Ains-



Campbell Island *J. H. Sorensen*

ROCKHOPPER PENGUIN CHICKS

worth, the rookeries of the Rockhopper Penguins are established on rocky surfaces near the sea, the nests being made under rocks, in niches, and among the tussocks. The nests would be constructed of small pebbles or were merely hollows in the soft mud. If grass was handy it would be used as a lining. Two or three eggs are laid and both birds take part in incubating, the period being about five weeks. Usually only one young is reared and it is fed by placing its beak within the parent's.

Concerning Macquarie Island, Falla has published some notes made by members of the Australian Antarctic Expedition of 1912-1913. According to these the first birds came ashore about October 15th, and by the 25th most of the rookeries were occupied. The first egg was found on November 9th and by the 11th they were plentiful. Adults were noted as moulting on April 5th and by May 5th the birds had completely deserted the island.

In early December, 1930, Falla observed large colonies of Rockhoppers around the whole coastline of Wireless Hill at the north end of Macquarie Island, but, he stated, the south and west of the island seemed to be the headquarters of the species. The lowest nests at the north end were amongst rocks just above high water mark and in some cases grass had been used for nesting material. The steep tussock slopes above the rocks were also occupied. Here the tall clumps of grass (*Poa foliosa*) hid a network of beaten tracks, the routes by which the birds travelled to their nests, which were placed among the roots of the tussocks. "There is no doubt," says Falla, "that the abnormal growth of the grass is the result of manuring by the birds." "In almost all the nests were two eggs, the dirtier and presumably older being much the smaller. Incubation on December 2nd and 3rd had not advanced in any case more than a few days and some birds had not laid at all."

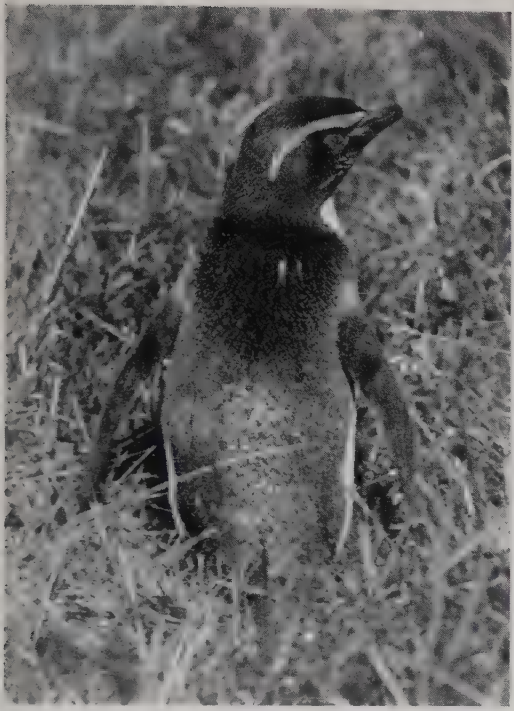
References.—Forster, Comm. Gott., 3, 135, 1781 (*Aptenodytes chrysocome,* Falkland Is.). Hutton, Proc. Linn. Soc. N.S.W., 3, 334, 1878 (*E. filholi,* Campbell Island). Buller, Birds N.Z., 2nd ed., 2, 290, 1888. Iredale and Cayley, Emu, 25, 4, col. pl. 1925 (*E. cristatus,* Mill.). Mathews and Iredale, Man. Birds Austr., 1, 11, col. pl. 1921 (*E. serresianus*). Mathews, Birds Austr., 1, 277, col. pl. N.Z. specimen, 1911. Murphy, Ocean. Birds S. Amer., 1, 415, 1936. Falla, B.A.N.Z.A.R.E., (B), 2, 87, 1937. Sorensen, Wild Life Subant., 49, 1951.

Fiordland Crested Penguin

Eudyptes pachyrhynchus

During Cook's second voyage a straggler of this species was taken at Adventure Bay, Tasmania, in February, 1773, when the *Adventure* called there. There is a sketch of this bird by George Forster in the British Museum. Its presence in New Zealand was not known to ornithologists until 1841 when the British Antarctic Expedition under Sir James Clark Ross brought to England a specimen obtained at Waikouaiti, Otago. As early as 1870 other examples were recorded from the Bay of Islands and Bay of Plenty and two years later a specimen was brought from the Chatham Islands by Travers.

Adult. Culminicorn viewed from above biconvex. Head dark bluish black; feathers of throat and cheeks with white bases which show as white lines when disturbed. A rather broad pale golden yellow superciliary band begins near each nostril, passes over and close to the eye and ends in a backwardly and downwardly projecting crest. Back lighter bluish black than the head, each feather with a narrow central streak of pale blue. Flipper margined behind in middle with one row of white feathers. Under surface behind the throat white, of flippers white with dark blue patch at base and apex and connecting band along the front. Bill reddish brown. Iris brown. Feet pinkish, the toes and soles dark brown. Bill 43-54, flippers 180-190, tail 66-85, tarsus 24-30, mid toe 68-77 mm. *Immature.* Similar to adult but yellow superciliary band shorter. Chin and throat greyish white. Bill gradually changing to reddish brown; feet to pinkish. *Nestling.* Head and upper surface sooty black; under surface behind throat creamy white. Bill black the tip marked with reddish and white; later the



Kapiti *A. S. Wilkinson*
FIORDLAND CRESTED PENGUIN

bill becomes black all over. Feet dull black. (Sutherland.) A nestling in the Dominion Museum, which may be faded, is dark brown with some of the lighter first down remaining.

Eggs. Clutch one or two, rarely three, ovate, pointed, bluish white, with white limey covering. 71 x 57, 70 x 51 mm. Dusky Sound. 69.5 x 53.5, 69.6 x 54 mm. Preservation Inlet.

Status. The Fiordland Crested Penguin is nearest related to the Snares Crested Penguin but is smaller, has a wider superciliary crest, lighter coloured plumage, the feathers of throat and cheeks often showing their white bases, and no white bare skin at the base of the bill. The bill of the Snares Crested Penguin is noticeably more massive than is that of the Fiordland Crested Penguin. The pattern of the under surface of the flipper is similar in both species but the frontal band of dark feathers is narrower in the Fiordland Crested Penguin.

Distribution. Breeding along the coast from Waitangi River in south Westland to Port Pegasus in Stewart Island, including the Solanders. A pair bred on an islet in Palliser Bay in 1953 and in 1954. Stragglers have been taken or observed at Bay of Islands, Bay of Plenty, Tuparoa, Petane, Castlecliff, Kapiti, Titahi Bay, Castlepoint, Palliser Bay, Wellington Harbour, Queen Charlotte Sound and many localities on the coast of Canterbury and Otago; also stragglers on Snares, Auckland and Campbell Islands. Straggler to southern Australia.

Ecology. The Fiordland Crested Penguin spends the early winter at sea. It comes ashore in July and normally leaves in February. It comes ashore to moult in various places away from its breeding area. When ashore it goes into caves and into the bush and hides under logs probably to avoid as much as possible the attacks of sandflies which are a great worry to both adults and young. This species is the only crested penguin which does not nest in the open and this may be due to the presence of sandflies. The only case of the harmful effects of Europeans on this species that I am aware of is the finding of a bird ashore at Castlepoint with oil on its feathers.

Food. In order to discover what kind of food the Crested Penguin ate Henry forced one to disgorge. He then found small fishes, whale feed (a small crustacean) and cuttlefish. Reischek found that the fish most commonly fed to the young was blue cod.

Nesting. The Fiordland Crested Penguin comes ashore to breed late in June or early in July. The eggs are laid in July and the chicks hatched in August. Reischek in Dusky Sound gives the nesting sites as caves and among rocks not far above high water mark. He says that the nests are made of sticks and leaves which the male brings while the female builds. Henry on Resolution Island says that the penguins make their nests in all sorts of places in the bush, Hollows at the roots of trees or under clumps of bush flax are favourite places. The nesting colonies, according to Henry, are always near fresh water which he often saw them drinking. Some birds will go a quarter of a mile into the bush to find water, sometimes up a steep gully. "One of the requirements for a nest appears to be a convenient dark place where the young ones can get out of the light to avoid the sandflies. They always stay out a good while when they are getting fed, and then the flies gather about them." In caves Henry says about half the nests are made of sticks laid about in disorder and about half are only damp and dirty hollows. About one in a hundred has a nest lined with dry grass or leaves. According to Henry the separate colonies have different times of breeding while the birds of one colony were of a slightly different plumage from the others. In one season Henry stated that the birds occupied a certain cave on June 29th, there were no birds in the cave two days before, and on July 22nd eight eggs were collected. The second egg is not laid until three or four days after the first.

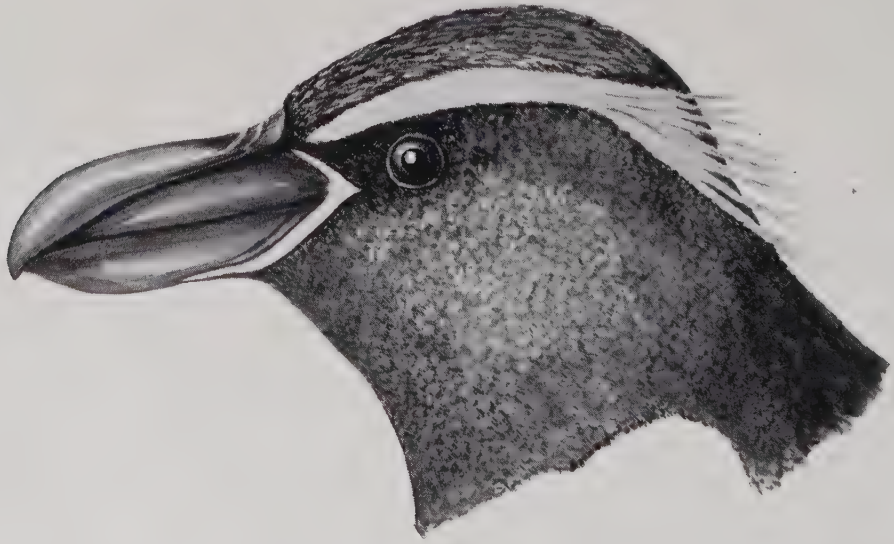
The Crested Penguins at Preservation Inlet were studied by R. S. Sutherland during a period of three years. In a large cave containing over sixty birds he found only two nests in which sticks were used; in all other cases the eggs were lying on the muddy floor. The first chicks were found on August 22nd. A month later the cave was deserted but in December there were eggs in all stages of incubation. Perhaps this was a second laying following the destruction of the first lot. The down of the chicks is not all lost until they are over four months old and chicks were in the nesting cave after they were seven months old. They take a full twelve months to complete their adult colours and full sized crests.

References.—Gray, Voy. Erebus and Terror, 17, 1845 (*E. pachyrhynchus,* Waikouaiti). Buller, Birds N.Z., col. pl. only, 1873 (*E. chrysocomus*); 2nd ed., 2, 287 (not the description of the adult); 299, 1888 (*E. pachyrhynchus, E. vittatus*). Sutherland, Emu, 20, 76, 1920; 23, 35, 1923. Henry, Flightless Birds, 34, 1903. Iredale and Cayley, Emu, 25, 4, col. pl. 1925. Falla, Rec. Auck. Mus., 1, 322, 1935.

Snares Crested Penguin

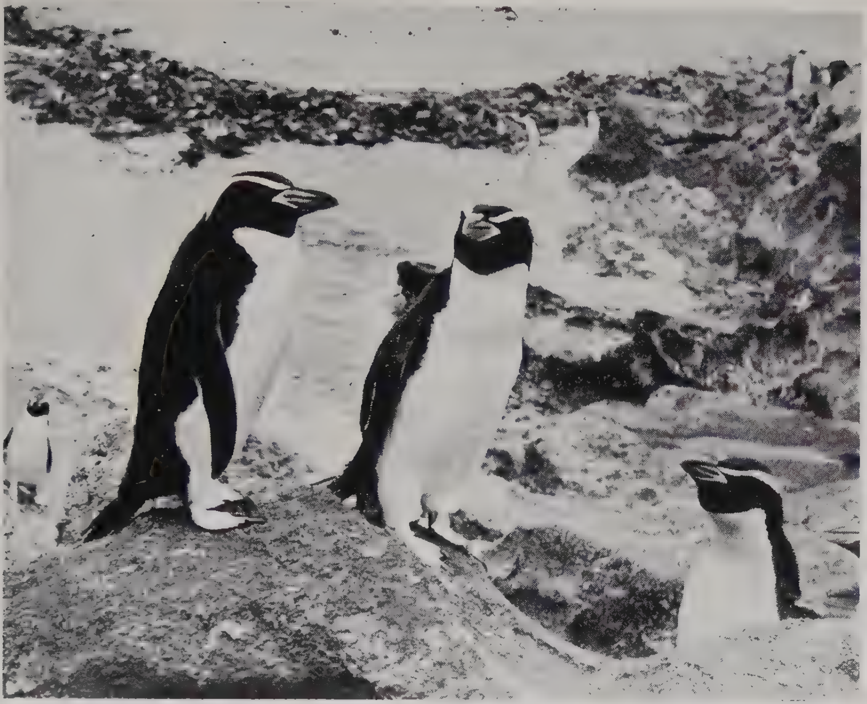
Eudyptes robustus

Though it had long been known that there were large colonies of penguins on the Snares Islands ornithologists did not



C. McCann

SNARES CRESTED PENGUIN



Snares Islands *R. C. Murphy*

SNARES CRESTED PENGUIN

distinguish them from the New Zealand species *pachyrhynchus*. When Reischek visited the Southern Islands in January, 1888, he found "thousands of penguins on the rocks standing like regiments of soldiers." He also says that "Some disease was amongst them, thousands were lying rotting among the black sand, and the stench was dreadful."

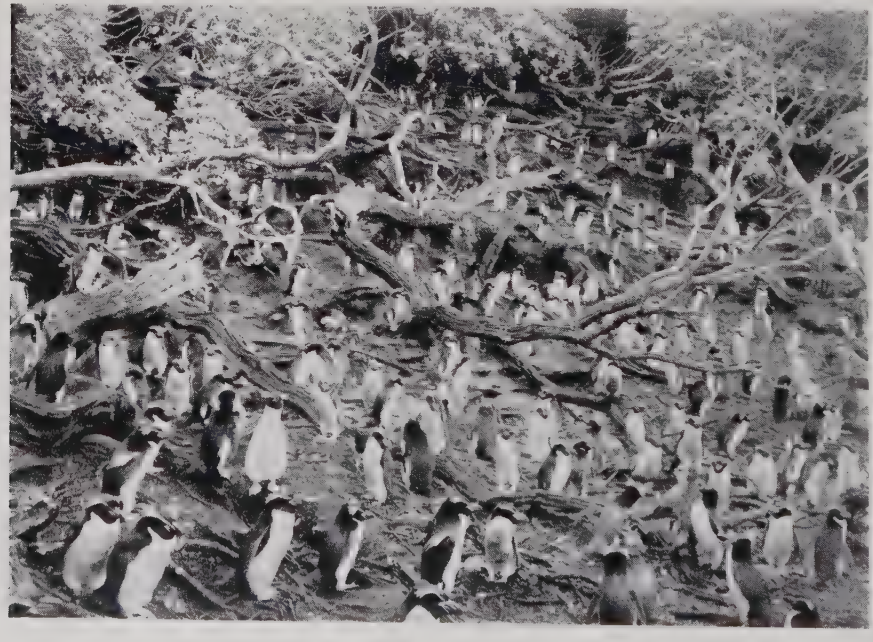
Adult. Culminicorn viewed from above posteriorly tapering and transversely grooved. Head jet black, paler on the crown; remainder of upper surface bluish black, each feather having a narrow central streak of pale blue. A rather narrow pale golden yellow band begins near each nostril, passes over the eye and ends in a backwardly and downwardly projecting crest. Flippers with whitish front margins and with one or two rows of white feathers along the posterior margin. Under surface behind the throat white; of flippers white with bluish black patch at base and apex and broad connecting band along the front. Bill reddish brown; bare skin at gape and along lower edge of lower mandible white. Iris brown. Feet pinkish white, with claws, soles and front of webs above dark brown. Bill 63, height at base 30, flipper 220, tail 90, tarsus 36, mid toe 64 mm. *Immature*. Similar to the adult but with shorter crest; chin and throat ashy white. *Nestling*. Head and upper surface sooty black, remainder of under surface white.

Eggs. Clutch two, ovoid, white. Clutch (a) 72 x 54.5, 68.5 x 50; (b) 72.5 x 57.5, 71 x 51.5 mm.; other eggs 64 x 49.5, 75.5 x 54.5 mm. (Stead).

Status. In the bowed culminicorn with concentric grooves at the base, and the position of the anterior end of the superciliary streak the Snares Crested Penguin agrees with *pachyrhynchus*. It differs in its larger size, especially the heavy bill, narrower superciliary streak, darker plumage, particularly the jet black head without the white bases of the cheek feathers showing, and the presence of white bare skin at the gape and along the lower edge of the bill. In this last character and in its size it comes close to *atratus,* but that species has the culminicorn parallel sided with longitudinal grooves at the base and the yellow superciliary streak originates near the gape and turns upwards.

Distribution. Snares Island, breeding in large numbers. Straggler to Akaroa, Hokitika, Antipodes Island and Macquarie Island.

Ecology. From their winter sojourn at sea the Snares Crested Penguin arrives for the purpose of breeding in August and finally departs in April. When coming in from the sea the penguins, as noted by Richdale, sometimes land feet first on the rocks. On land the penguins walk upright but if pursued they flop down and use their flippers as forelegs. When climbing up steep rocks they use their bills as well. On the Snares the birds form colonies over most of the island being found both among the low scrub and tussocks and in the low Olearia forest. They tramp down the smaller plants, killing also the shrubs of the coastal koromiko (*Hebe elliptica*). This effect is also no doubt partly due to the rich guano soil. In the tussock country the grasses are completely killed and the surface soil eroded and washed away leaving the boulders standing out. In the forest all undergrowth disappears and some of the trees are killed. Richdale says: "Apparently, all colonies were originally begun in the bush. In some cases the birds are still nesting under living trees, but in other places, the trees are dead; in still others there is a fair amount of soil and no dead trees, but with branches and trunks lying about; and, finally, the more ancient breeding grounds consist of bare rock with all the soil washed away. This is a splendid example of erosion and should serve as a warning to us of what could overtake the whole island should the Olearia forest be removed." Stead, how-



Snares Islands *E. F. Stead*

SNARES CRESTED PENGUINS

ever, thought that the penguins preferred nesting sites open to the sky. He relates that the penguin colonies were centres of attraction for the three kinds of land birds on the Snares, snipe, black tit and fernbird, "all of which found in them their most concentrated food supplies". Tits and fernbirds were seen collecting white maggots from the mud. The penguin colonies are in close proximity to the breeding places of sea lions (*Arctocephalus hookeri*) which never molest the birds while on land. Nor is this to be wondered at seeing the filth in which the penguins are wading. At sea the penguin is included in the sea lions' fare.

Voice. The noise emanating from a colony of Snares Crested Penguins is thus described by Stead: "The most amazing thing about a penguin colony is the noise. They have a staccato bark that sounds in the distance like someone chopping wood; soft musical whistles that may give way to a series of gutteral quacks reminiscent of an old drake in a farmyard; harsh screams of anger or alarm, and a number of grunts that sound in the distance like humans talking."

Nesting. The colonies of penguins on the Snares are numerous and in some cases extensive. They are found from the sea coast to about 400 feet above sea level. They may be in the coastal scrub, in the tussock country or in the Olearia forest. There is also a colony on the bare rocky Western Reef. A photograph, taken November 15th, 1907, of a large colony surrounded by tussock and scrub, shows many of the nests as crater-like structures perhaps formed by the birds scraping up mud while sitting on the nest. The sides were thickly marked with white radiating lines. Some nests are in the centres of much flattened tussocks. A good many sticks are lying about between the nests. Stead says: "The penguins build good nests—a foundation of sticks a foot to eighteen inches long and up to an inch thick, lined with leaves and tufts of grass. The nests are placed about 2½ feet apart in rows, the alleys between the rows being some 3 feet wide."

References.—Oliver, Emu, 53, 187, 1953 (*Eudyptes robustus*, Snares Is.). Buller, Birds N.Z., 344, not the plate, 1873 (*E. chrysocomus*); 2nd ed., 2, 287 (description of adult), 1888. Falla, Rec. Auck. Mus., 1, 324, 1935. Richdale, Island Outpost, 116, 1948. Stead, N.Z. Bird Notes, 3, 70, 1948.

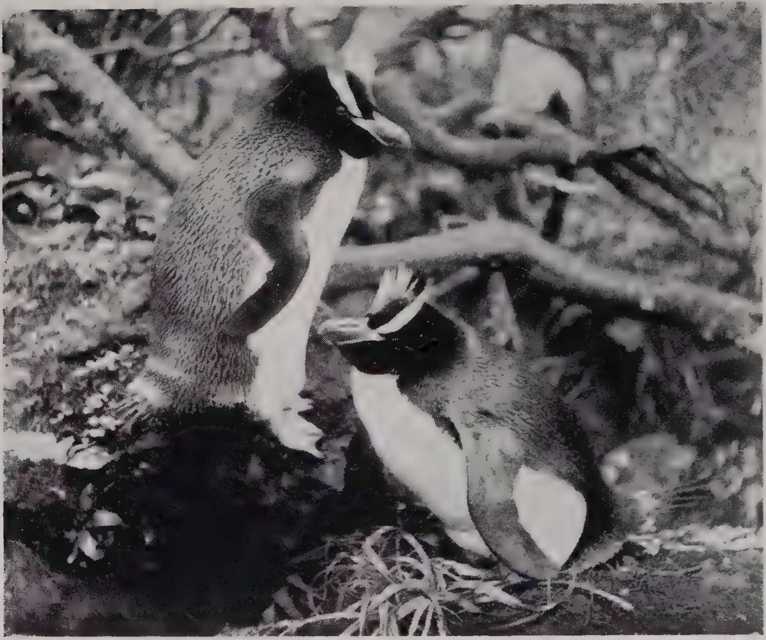
Erect-crested Penguin

Eudyptes atratus

In 1874 a black penguin attracted the attention of a collector on the Snares Island. The specimen was submitted to Hutton and he drew up a description of it which Finsch published in 1875. The name *atrata* which was bestowed on it, though totally inapplicable to any species of penguin in normal plumage, is, however, by the rules of zoological nomenclature, the one that has to be adopted for the species. The type specimen was forwarded to England for the purpose of being figured in the second edition of Buller's *Birds of New Zealand.* A painting was made by Keulemans and reproduced in colour in Buller's work. This and Hutton's description of the bill enable us to refer the bird to the species described by Buller in the same work under the name *Eudyptes sclateri.* Unfortunately the specimen was lost on the return voyage to New Zealand in the wreck of the barque *Assaye.*

A specimen of this penguin was collected at the Auckland Islands in 1888 and forwarded alive to the Zoological Gardens, London. The bird died shortly after its arrival and Sir Walter Buller, who was then in London, described it in the second edition of his *Birds of New Zealand,* which was then in course of publication. The following year the species was discovered by Reischek breeding in large numbers at Antipodes Island and in 1891 Sir F. R. Chapman found immense colonies of them at the Bounty Islands.

Adult. Culmen with parallel sides, longitudinally grooved at the base. Head jet black. Remainder of upper surface bluish black, each feather having a narrow central streak of pale blue. A pale golden yellow superciliary band beginning on each side of



Otago Peninsula *L. E. Richdale*

ERECT-CRESTED PENGUINS

the head near the base of the upper mandible immediately above the angle of the mouth, passes over the eye and ends in a backwardly and upwardly projecting crest. Flipper margined behind with two or three rows of white feathers; a narrow margin of white showing in front near the base. Tail coverts mostly white. Under surface below the throat silky white, except the proximal and distal ends of the flippers and a broad connecting band along the anterior margin which are dark bluish black. Bill reddish brown; bare skin at gape and strip along lower edge of lower mandible white tinged with pink. Iris brown; eyelids brownish black. Feet pinkish white, the claws, soles and front margin of webs above brown. Bill 52-60, flipper 190-220, tail 114-128, tarsus 30-35, mid toe 77-84 mm. *Immature.* Differs from the adult in the throat being ashy white, and the superciliary band white to pale yellow. *Nestling.* Head, throat and upper surface smoky brown; under surface white. Bill blackish with a light tip. Feet blackish.

Colour variety. A partial albino having the back white, sparsely spotted with black, was observed by Archey at the Antipodes Island. A bird entirely black except for the crest, which was the normal colour, was taken at the Snares Islands in 1874, and another came ashore at St. Kilda, Dunedin, in 1934.

Eggs. Clutch two, ovoid, blunt-pointed, pale bluish, chalky outside, 83 x 59, 86 x 56, 87 x 60 mm. Antipodes Island. 96 x 58.2, 96 x 56.5 mm. Bounty Islands. 88 x 58, 92.5 x 57 mm. Otago Peninsula. Richdale records that in the same nest as the last egg, 92.5 x 57 mm., there was a second laid egg 75 x 49 mm., that is, under average size.

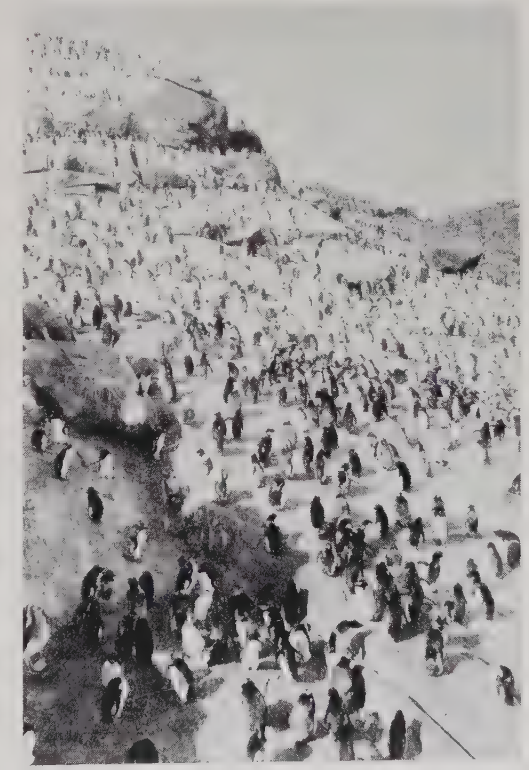
Status. The Erect-crested Penguin differs from all the other members of the genus Eudyptes in the parallel-sided culminicorn longitudinally ridged at the base. It further differs in the yellow crest originating near the gape and in the feathers of the hinder part of the crest being more or less erect. Its nearest relative is *E. robustus* of the Snares with which it agrees in its large size and white bare skin at the gape and along the lower edge of the lower mandible.

Distribution. Breeds in large numbers on Antipodes and Bounty Islands. There are small breeding colonies on Campbell Island, and a few pairs breeding on Otago Peninsula. Stragglers have been found at the Snares, Auckland, Macquarie and Chatham Islands and, on the main islands of New Zealand at North Cape, White Island, Castlecliff, north side of Cook Strait and Wellington Harbour, Cape Campbell, New Brighton, Birdlings Flat and Timaru. Visitor to South Australia.

Habitat. On the Southern Islands the Erect-crested Penguin when on shore seems to go no further inland than the rocky slopes facing the sea. On Antipodes Island its colony is just above the beach but on the Bounties it ascends to the top of the highest rocks. There is no vegetation on the Bounties, its growth being prevented by a covering of guano made by countless numbers of these penguins. The birds are to be found on these rocks from September to April, that is at least eight months of the year. As with the other species of penguin their destination during the winter is mostly unknown, though a fair number are found off the coast of the South Island of New Zealand at this time of the year.

An intensely interesting scene is presented at the Bounty Islands during fine weather. The sea on the leeward side seems to be full of penguins. Many appear just to be resting on the water, others on more serious business are fishing or swimming to or from the shore where their young await their arrival for their food. Coming close to the shore a wonderful sight is presented. All day long, streams of penguins are leaving the islands for sea; others are landing. At the landing place is perhaps one of the most remarkable sights to be seen in the bird world. The penguins going seaward, dirty to be sure, form a continuous stream of birds taking headers into the sea. The landing parties make an interrupted stream, the actual landings being determined by the wash of the waves. Batches of birds coming inshore dive beneath the surface a few yards from the rocks then shoot up on a wave and cling to the rock with bill, flippers and feet. Not all secure a safe hold so that a proportion fall back into the sea to come ashore in a subsequent landing party. Proceeding up the slippery rocks from the water's edge, the clean birds file past the dirty ones carefully avoiding contact with the downward going party lest their plumage should be soiled.

On the Otago Peninsula Richdale and Marples found the Erect-crested Penguin nesting in scrub about an eighth of a mile from the shore.



Bounty Islands *G. M. Turner*
ERECT-CRESTED PENGUINS

Nesting. The breeding colony of the Erect-crested Penguin on Antipodes Island occupies the beach above storm level and the lower rocky slopes of the cliff. Immediately above, the slopes are occupied by the Rockhopper Penguin, the two species forming a continuous colony.

They nest among the rocks which are here large boulders, rounded on the shore but angular further up the slope, the whole surface being covered with a layer of strong-smelling guano. The nest consists merely of a hollow in the muddy ground. At the time of my visit, April 4th, young birds assuming their first plumage and adult moulting birds were present.

The Bounty Islands comprise a group of granite rocks lying about 90 miles to the northward of the Antipodes. Ever lashed by the waves, which in storms pass over all the islands, the rocks are not in all places habitable even for penguins. The occupied portions are, however, visible from a great distance as their surface, covered with a film of guano, shows whitish in contrast with the dark unoccupied portions. Though the total area is about ten acres, every portion which is not too steep or comes under the influence of ordinary rough weather is occupied by Erect-crested Penguins. The islands can be picked up in misty weather by their smell long before they are sighted. The number of birds must be counted by hundreds of thousands. No nest is made; there is indeed nothing to make nests of except feathers and guano. The eggs are simply laid on the rock surface or in crevices if not filled with liquid guano and the egg kept in position by the sitting bird. According to Captain Fairchild the eggs are laid in October.

In the colony itself the chatter of the penguins is deafening and the stench almost unbearable. Every available piece of standing room is occupied by penguins. Even ledges on cliffs accessible neither from above nor below had their penguins, no doubt fallen there accidentally.

The following information on the breeding colonies of the Erect-crested Penguin on Campbell Island has been kindly supplied me by Mr. J. H. Sorensen who spent several seasons on the island attached to a weather observing and military watching party. The colonies of this penguin on Campbell Island are small and, as far as is known, included in the much larger colonies of Rockhoppers. On October 2nd, 1945, about 170 Erect-crested Penguins were observed north of Mount Azimuth. They arrive and begin breeding earlier than the Rockhoppers. Moulting of the adults took place in February and March.

Of the Erect-crested Penguins breeding on Otago Peninsula Richdale has written a detailed account covering a nesting season. A nest was found in scrub nine chains from the sea coast. An egg was laid on October 21st and a second and smaller one two days later. This second egg was later ejected from the nest by the parents and the larger one became addled. It is not known whether two eggs is the normal number in a clutch and if so whether the ejection of one of them is a regular and normal procedure. In spite of disaster to the eggs very interesting information on the behaviour of the parents during the incubation period was obtained. The method of covering the eggs in the nest is similar to that of the Royal Penguin and is described by Richdale as follows: "One end of the egg rested on the ground, but most of it was on the feet of the sitter, whose toes were turned in to prevent the egg from rolling forwards. Sitting up with the body at an angle of 45 degrees the bird then pushed its fold of skin over the egg, covering it completely in King Penguin fashion. . . . The bird may vary this posture by lying flat down on the breast in *Megadyptes* style."

References.—Hutton, ex Finsch, Ibis, 1875, p. 114 (*Eudyptes atrata,* Snares Id.). Buller, Birds N.Z., 2nd ed., 2, 289, 1888 (*E. sclateri,* Auckland Id.). Iredale and Cayley, Emu, 25, 5, col. pl. 1925. Richdale, Emu, 41, 25, 1941; Sexual Behavior Penguins, 1951.

Royal Penguin

Eudyptes schlegeli

The Royal Penguin was well known to the early sealers. It was not until 1876, however, when a specimen from Macquarie Island was described by Otto Finsch, that the species became known to science. In 1880 Scott who visited Macquarie Island found it breeding in larger colonies than any other species. Fourteen years later it became the basis of an oil industry which operated for nearly twenty-five years.

Adult. Culmen viewed from above biconvex. Forehead and crown blue-black; a frontal band of golden yellow which increases over the eyes and develops into superorbital crests of bright golden yellow mixed with black, the longest of the superciliary feathers uniform golden yellow; feathers of the middle and sides of the crown golden yellow at the base with lengthened pointed black extremities. A narrow band of sulphur yellow surrounds the upper mandible and fills the lores. General colour above bluish black, each feather having a central stripe of dark blue; upper tail coverts often mostly white; flippers margined behind with one or two rows of white feathers. Round eye and temporal region grey; throat and under surface white; a slight wash of grey on the foreneck. Under surface of flipper with patches of bluish black at base and tip and broken band along front. Bill red-brown, bare skin at gape pinkish. Iris reddish-brown. Feet flesh pink, soles brownish black. Bill 60-74, flipper 210-225, tail 80-108, tarsus 30-35, mid toe 70-88 mm. *Immature.* Differs from the adult in the upper surface being brownish black, sides of face and chin smoky brown, throat, ashy white. Superciliary band a narrow line of light yellow. Some of the frontal feathers are pale yellow marked with black. *Nestling.* Upper surface, throat and foreneck fuscous, darker on the head; remainder of under surface greyish white. Bill blackish brown. Feet fleshy grey. *Colour varieties.* Albinos, black varieties, and partial albinos and black varieties of the Royal Penguin have been collected. There is an albino in the British Museum entirely white except for the golden superciliary plumes. A specimen which is white except for the flippers, top of the head, neck and some flecks on the back is figured in Mawson's *Home of the Blizzard*. A specimen in the Otago Museum has the upper parts pale brown, with the crest lemon yellow, and the underparts white; and another is bluish black above, grey on the throat, and has the remainder of the under surface black.

Eggs. Clutch one. Ovoid or sometimes pyriform, pale bluish, granulated. 73 x 60, 77.8 x 58, 79.8 x 59.5 mm. Macquarie Island.

Macquarie Island *A.N.A.R.E.*
ROYAL PENGUINS

Average of 44 eggs measured by Falla, 73.9 x 53.2 mm.

Status. The Royal Penguin forms with the Macaroni Penguin (*E. chrysolophus*) of the South Atlantic and Indian Oceans a section of the genus characterised by the crests meeting across the forehead and the tail having 14 feathers. It differs from the Macaroni Penguin in the sides of the face and throat being white or greyish white instead of blackish. Two specimens from Macquarie Island have dark grey throats as in *E. chrysolophus*.

Distribution. Breeding in immense colonies on Macquarie Island. Elsewhere a straggler only and recorded from Campbell Island, Lyall Bay, Waikouaiti, Brighton (near Dunedin), Taiaroa Head and Napier. Straggler to Tasmania and Southern Australia.

Ecology. The Royal Penguins are at sea from the end of April until the end of September. Where they go is a mystery. About a million birds leave Macquarie Island at the end of the summer yet only a few stragglers have been recorded on the coasts of New Zealand, Campbell Island and Tasmania. On land their rookeries, states Ainsworth, are always close to a running stream which forms the highway along which they travel to and from the sea. From various accounts it appears that the newly fledged birds leave the island in March. Next season they come ashore in September and October, spend a month at sea in midsummer, come ashore in February to moult and depart with the young of the year in March. The adults begin to come ashore towards the end of September, go to sea in February and return to moult in March, finally leaving that month or the first half of April.

The Royal Penguin supplies most of the food required by skuas during their breeding season. Falla says: "The Southern Skua (*Catharacta lonnbergi*) nests simultaneously with the penguins, and certain pairs of these skuas feed exclusively on penguins' eggs. The skua chicks, two in each nest, are then fed upon young penguins which are obtained without difficulty. The old skuas seldom seemed to miss in their swoops upon unguarded chicks, and the defensive opposition was always too late and futile. A further factor possibly contributing to high mortality is the long period (about six months) spent at sea by Royal Penguins, both old and young, during the winter."

Nesting. The following account is based on that of Ainsworth in Mawson's *Home of the Blizzard*. The Royal Penguin forms larger rookeries than any other species visiting Macquarie Island. One colony at the south end of the island covers 16½ acres, while at the Nuggets there are numbers of them scattered along the banks of a creek and aggregating ten acres. They arrive towards the end of September and immediately take up their quarters in the rookeries.

A well ordered procession is arranged whereby those going up keep to one side of the creek and those coming down to the other. In the rookery, however, are fights, squabbles and riots arising from various causes, the chief of which appears to be a disposition on the part of some birds to loiter about, and the attempt on the part of others to steal stones from neighbouring nests. The nests are made of small stones and occasionally bones from the skeletons of dead penguins. As the season advances the breeding places become covered with filthy slush but this does not seem to affect incubation of the eggs.

Bickerton, who visited Macquarie Island in 1895, supplies further interesting details. He states for instance that only one egg is laid and both male and female take turns in incubation. The egg is laid on the ground and the parents take turns in lying forward on it. Both parents also assist in feeding the young until it is about three months old when it goes to sea.

The method of holding the egg while it is being incubated is more precisely described by Falla. He says: "At the change of guard

Macquarie Island *A. Hamilton*

ROYAL PENGUINS

the relieving bird would first tuck the egg up on top of its feet, and then gradually crouch down until a large bulge of skin and feathers of the lower belly rested on top of it. Many thereafter leaned bodily forward, but the egg appeared to retain its original position, more or less on and between the feet." The Australian Antarctic Expedition collected eggs, from one of the first batches of the season, on October 19th. On December 2nd, 1930, Falla records chicks not more than a day or two old which dates, he observes, indicate a period of incubation of six weeks or a little more.

Penguin oil industry. For many years, from about 1894 until 1918, Royal Penguins formed the basis of an oil industry, this species being selected because it occurs in such large numbers. Gangs of men were landed from a small vessel at the beginning of the season and were picked up together with the oil at a later date. The following account of this industry is given by A. Tulloch, who was in charge of the Mawson Wireless Station. "There are about 150,000 birds killed every season at The Nuggets. The first oil season commences about the beginning of January and lasts for three weeks, until the old go to sea. In February both the old and the previous year's young (which are very fat) return in great numbers to moult. This time they are detained on the beach as far as possible by the sealers, who put wire netting across the creek. Flocks of birds are driven into a wire netting enclosure and the young fat birds are drafted off and clubbed and put into a digester. This is about the most humane and only practical way of killing the birds. The oil industry at the present scale has very little effect on the Royals."

A description of a slightly different procedure from the one described by Ainsworth, is published by Falla from Waite's report on his visit to Macquarie Island in 1912. "The penguin 'season' began in February when the year-old young or 'fats' came out of the sea to moult. It was from these birds that the first toll was taken. Adults returning to the sea after nesting were allowed to do so, as they also fattened before coming out to moult in March, when a number of them were taken. The whole season was thus continuous for about six weeks, and fat yearlings followed by fat adults were the victims."

References.—Finsch, Trans. N.Z. Inst., 8, 204, 1876 (*E. schlegeli,* Macquarie Id.). Milne Edwards, Ann. Sci. Nat. (6), 9, 55, pl. 19 1880, (*E. albigularis,* Macquarie Id.). Buller, Birds N.Z., 2nd ed., pp. 297, 398, 1888 (*E. chrysolophus, E. schlegeli*); Suppl. 1, 90, 1905. Wilson Nat. Ant. Exp. Aves, 60, col. pl. 1907. Falla, B.A.N.Z.A.R.E., 2, 100, 1937.

GENUS EUDYPTULA

Bill moderate, compressed, upper mandible hooked at the tip, groove between culminicorn and latericorn inconspicuous. Flippers short. Tail very short, of 16 feathers, almost concealed by the upper tail coverts.

Eudyptula differs conspicuously from all the other penguins of the New Zealand region by its small size and absence of superciliary streaks; it approaches more nearly Spheniscus which comprises four species found in South America and South Africa, but can be separated from that genus by the absence of ridges on the basal portion of the bill and white superciliary streaks. The general colour of the species of Eudyptula is blue above and white below.

Eudyptula is confined to Australia and New Zealand and consists of a number of forms which may be arranged under two species, one coinciding in distribution with the area of the genus, the other restricted to Banks Peninsula.

Key to Species and Subspecies

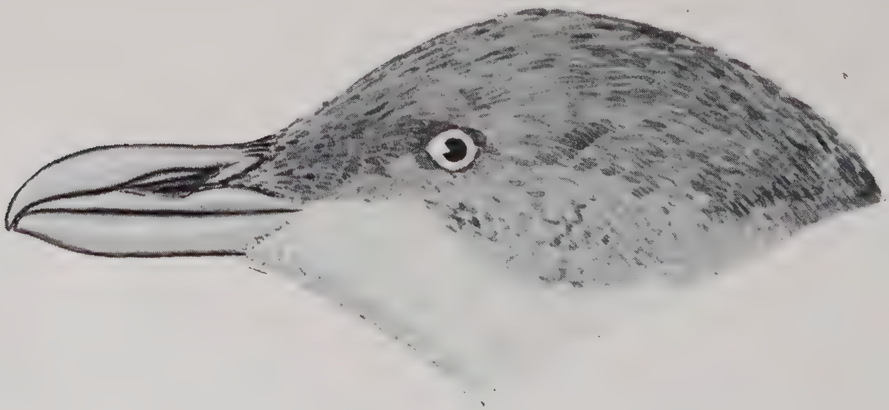
Flippers with posterior margins white.
  Upper surface light blue, the feathers with black margins .... *E. m. novaehollandiae*
  Upper surface deep blue .... *E. m. minor*
Flippers white on both margins and in patch at centre .... *E. albosignata*

Reference.—Bonaparte, Compt. Rend., 42, 775, 1856 (*Eudyptula,* type *Aptenodytes minor,* Forst.).

Northern Blue Penguin

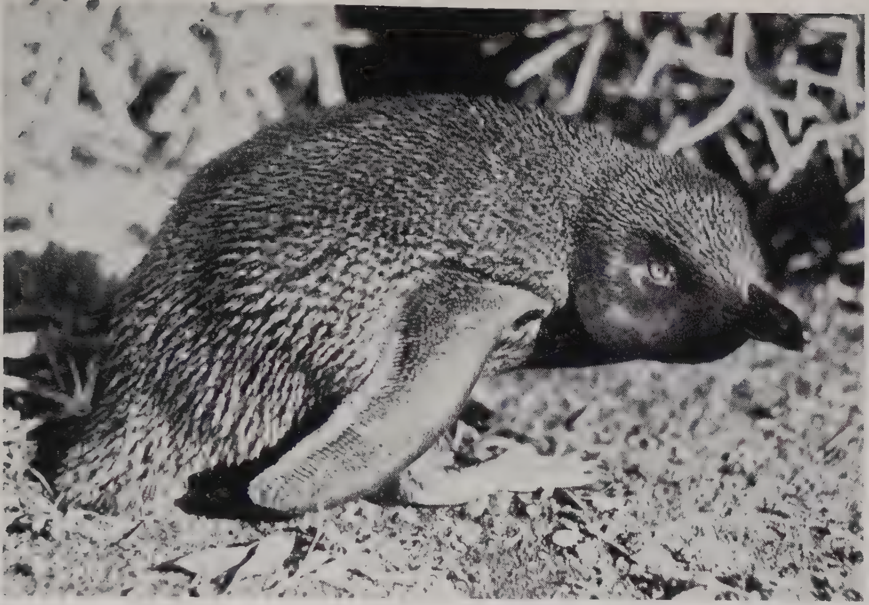
Eudyptula minor novaehollandiae

The Blue Penguins of Australia, the North Island and the northern portion of the South Island of New Zealand are so similar that they are regarded as belonging to the same subspecies which, although known in Australia at the end of the eighteenth century, was not given a scientific name until 1826. In that year Stephens, with a bird from Port Jackson in hand, described it under the name *Spheniscus*



E. H. Atkinson

NORTHERN BLUE PENGUIN



Castlecliff *W. P. Mead*

NORTHERN BLUE PENGUIN

novaehollandiae. In New Zealand it was found by the officers of the American Exploring Expedition, in 1840, to be common at the Bay of Islands.

Adult. Upper surface light blue, the feathers with black shafts and margins; flippers with one or two rows of white feathers on the posterior border; in some birds some of the tail feathers are white or partly white; sides of face below eye, neck and breast greyish. Under surface white. Bill dark brown, blackish on the culmen. Iris silvery grey. Feet pinkish white; the webs, claws, back of tarsi and soles blackish brown. Bill 35-38, flipper 127-140, tail 25-30, tarsus 20-25, mid toe 50-55 mm. *Immature* similar to adult but brighter blue above. *Nestling.* First down sooty brown above, greyish on throat and foreneck; breast and abdomen white. Second down lighter. *Colour varieties.* Buller records a pure white specimen from Mercury Bay and M. E. Johnson records another from Whangaroa.

Eggs. Clutch two, ovoid, white, 51 x 40, 52 x 41, 53 x 40.5 mm. Tauranga.

Status. Blue Penguins from New Zealand and Australia are practically identical. White feathers in the tail are not usual in New Zealand examples. According to published descriptions they are more frequent in Australian birds, but Littler says that the tail is seldom white in Tasmanian Blue Penguins. The colour of *E. m. novaehollandiae* is similar to that of *E. albosignata* and it is conspicuously different from that of *E. m. minor.*

Distribution. Three Kings Islands (not known to breed). North Island and northern portion of South Island. Mokohinau, Hen and Chickens, Little and Great Barrier Islands, Mayor Island, Karewa, Kapiti, D'Urville Island, Chetwode Islands.

Southern and eastern coasts of Australia from Swan River to Moreton Bay, and in Tasmania.

Ecology. The Northern Blue Penguin frequents the coastal waters and is never seen far from land. It is not gregarious but is usually seen singly or a few together swimming with their heads and perhaps some of their backs above the surface of the water.

It seems able to inflate itself or its feather covering in some way for it sometimes floats on the surface and goes to sleep with a considerable portion of the back above water and if disturbed takes a little time to deflate before it is able to dive. Ashore it seldom comes beyond the coastal rocks, hiding in crevices or under stones. Occasionally it may climb a considerable distance, up to a mile, to seek a nesting site, and it can on occasions climb quite precipitous slopes. In the winter months, especially during storms, it comes ashore now and then to take shelter in its nesting holes. Not infrequently it is caught by the waves and killed by being pounded on the rocks. At other times it is washed ashore on sandy beaches in considerable numbers. Near Mount Maunganui M. Hodgkins says that "Very large numbers are stranded on the beaches in certain seasons, either dead, or in a dazed and helpless condition. The period of stranding is usually December or January. . . . Now and again the deposit becomes greatly increased, as in December, 1943, when for an unknown distance east of Mt. Maunganui the open coast was found to bear dead penguins at almost every three to six feet. This deposit was at least seven to nine miles long, and no heavier has been seen." The Northern Blue Penguin swims under the surface of the water with great speed, the propelling power being the flippers. It may thus be said to fly under water. The feet are brought together and lie straight behind.

Like almost all other birds on the mainland of New Zealand and on islands occupied by Europeans this penguin has suffered a reduction in its numbers through clearing of scrub and forest from its nesting sites; being killed by dogs, cats, stoats and ferrets; being covered with oil discharged from ships; and, lastly, where it crosses a coastal road to breed, being run over by motor cars.

Food. Small fishes and other marine organisms form the food of this penguin. On calm days penguins may be seen fishing in the coastal waters, frequently diving beneath the surface. The food is swallowed while the birds are below.

Describing the Northern Blue Penguin's method of catching fish in Whangaroa Harbour T. M. Roberts says: "The small fish were herded into a tight circular dark pack three feet across. The penguin then drove through the pack and surfaced. Heads and tails protruded from its bill. These were quickly swallowed and it rounded up the fish pack again driving through and surfacing again up to 10 or 15 times."

Voice. The song of this bird, perhaps it should be called a noise, is a wailing cry heard throughout the breeding season. It is a weird note produced by alternate inspiratory and expiratory moans, quite resembling the noise made by some shearwaters, especially the wedge-tailed shearwater.

Nesting. The Northern Blue Penguins breed all along the coast coming ashore during August and September and searching for crevices, burrows and similar places in which to place their nest. Usually they select a crevice or cave along the shore but if none be handy they go into the bush and make a burrow beneath a log or among the roots of a standing tree. Laying begins about the middle of September. The period of incubation as observed by Wilkinson on Kapiti Island is 38 days. In a nest at York Bay, Wellington Harbour, watched by Hursthouse the chicks left after 55 days. Describing the method of feeding the chicks Hursthouse says: "Each chick, prior to receiving food, plays around the head and bill of the feeding bird for some moments until that bird opens its bill. The chick then puts its head completely inside, and with a number of movements of the feeding bird the food is produced and the chick withdraws. This is repeated several times for each chick. When six weeks old the chicks were too large to get their heads in, . . . the feeding was otherwise precisely the same as when they were quite young."

References.—Stephens, Shaw's Gen. Zool., 13, 68, 1826 (*Spheniscus novaehollandiae*, Port Jackson). Buller, Birds N.Z., 347, 349, not plate, 1873; 2nd ed., 2, 300, 302, 1888. Hursthouse, Emu, 40, 121, 1940. Wilkinson, Kapiti Bird Sanct., 114, 1952.

Southern Blue Penguin
Eudyptula minor minor

The Southern Blue Penguin was first discovered in 1773 in Dusky Sound during the second voyage of Captain Cook. Forster, who was a member of this expedition, described the species in 1781. H. H. Travers brought specimens from the Chatham Islands in 1871.

Adult. Above deep blue, each feather with a black shaft: two rows of white feathers on posterior margin of flipper. Under surface satiny white. Bill dark horn colour, blackish on culmen and grey on the lower mandible. Iris silvery grey. Feet pinkish white; webs, claws, back of tarsi and soles black. Bill 32-42, flipper 107-130, tail 24-35, tarsus 22-26, mid toe 45-54 mm. *Nestling.* First down almost black on head, lighter on back; under surface light grey, almost white; second down dark carmine grey, throat and foreneck light grey, breast white. Feet violet grey, soles and claws darker. (Richdale.)

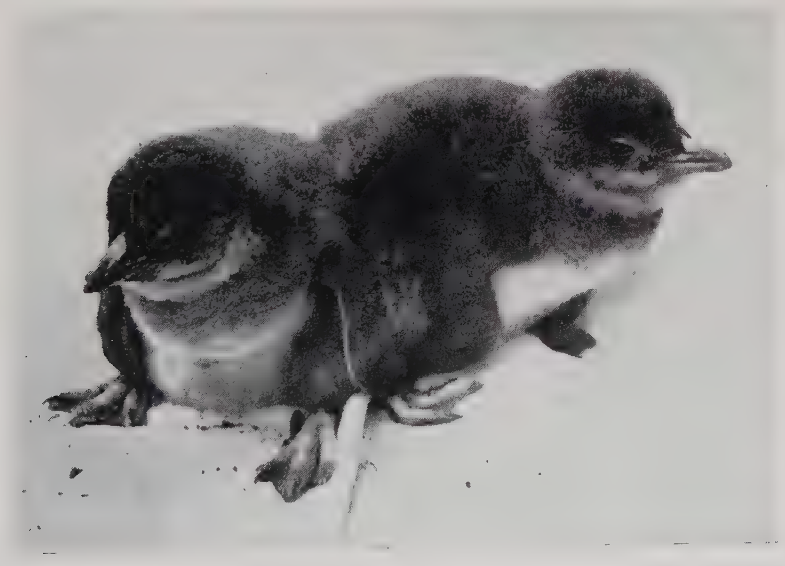
Eggs. Clutch two, ovate, white, 54.5 x 42, 57.1 x 42, 59.7 x 44.5 mm. Chatham Islands.

Status. Differs from *E. m. novaehollandiae* and from *E. albosignata* in its deep blue almost uniform coloration, and from *E. albosignata* in having a white border on the posterior edge of the wing only. I have not seen a specimen with white feathers in the tail.

Distribution. Otago, Stewart Island, Codfish Island, Chatham Islands, breeding; ranging north to Cook Strait.

Ecology. In the Chatham Islands Fleming states (1937) that there is a strongly held opinion among the islanders that this penguin is now more plentiful than it was thirty years ago. In Stewart Island and Southland Southern Blue Penguins are killed by skuas.

Nesting. Nests of the Southern Blue Penguin have been found in forest a mile from the sea in Dusky Sound (Reischek), and on Mangere Island in the Chatham group at the same distance from the sea and at an altitude of 900 feet. (Archey and



Otago Peninsula *L. E. Richdale*

SOUTHERN BLUE PENGUIN CHICKS

Lindsay). The nests are usually found singly or a few together, though in some localities a great many may be found in a single colony. Thus Archey and Lindsay state that large numbers are found breeding on steep slopes strewn with rocks and sparsely covered with trees on Mangere Island.

In the Chatham group the Southern Blue Penguin burrows in the peaty ground on Mangere Island, and on Wharekauri, as recorded by Fleming, it uses the deserted burrows of the mutton bird. Usually this penguin's burrows are quite short, up to two or three feet in length, though Reischek states that he found a nest at Dusky Sound in a burrow twelve feet long. The nest is made of sticks, leaves, seaweed and grass according to the material at hand. Guthrie-Smith describes the nests on Stewart Island as being made of sticks, and muttonbird scrub (*Senecio puffini*) leaves. Reischek says the male brings sticks and other material to the female to build with. The usual laying month is November but Richdale has found nests on Otago Peninsula in June and July. On Otago Peninsula Richdale found the period of incubation to be thirty-nine or more days. Both birds share in incubating the eggs. In recording the periods that ten penguin chicks stayed in the nests Richdale gives 51 to 58 days.

References.—Forster, Comm. Gott., 3, 147, 1781 (*Aptenodytes minor*, Dusky Sound). Buller, Birds N.Z., col. pl. only, 1873. Mathews, Birds Austr., 1, 286, col. pl. 1911 (*E. m. iredalei*, Chatham Islands). Guthrie-Smith, Mutton Birds, 63, 1914. Stuart-Sutherland, Emu, 20, 81, 1920. Fleming, Emu, 33, 390, 1939. Richdale, Emu, 40, 180, 1940.

White-flippered Penguin

Eudyptula albosignata

This penguin was first recognised as a distinct species in 1874 by Dr. Otto Finsch who received two specimens which had been taken at Akaroa.

Adult. Above greyish black each feather with light blue centre and black shaft, sides of head, neck and breast greyish, a white band across the base of the tail above; flippers broadly margined with white on both the front and hinder edges and there is also a patch of white at the carpel flexure continuous with the hinder white margin and sometimes with the front one as well. Under surface white. Bill dark bluish brown, darker on the culmen. Iris light steel grey. Feet pinkish white, the webs, claws, soles and back of tarsi blackish brown. Bill 35-38, flipper 120-133, tail 28-35, tarsus 23-25, mid toe 50-63 mm. The bill in the female is more slender than it is in the male and not so hooked at the tip; the white patch on the tail is small or absent. *Nestling.* First down grey brown, margin of flippers and under surface whitish buff. Iris dark brown. Feet pink. Second down a little lighter than the first; margin of flippers and under surface white. Iris blue grey. Feet white, back of tarsus, soles, webs and claws black.

Eggs. Clutch two, ovoid, white. 57 x 40.5, 54 x 41 mm. Taylors Mistake. 46.5 x 42.7, 54 x 41, 61.5 x 43.5 mm. Lyttelton Harbour.

Status. This species may be regarded as a local development of the Northern Blue Penguin. It is rather larger, but the essential distinguishing marks are the continuous white patch above the tail and the large amount of white on the flippers. These characters are, however, not constant. The white tail patch may be absent in the female and the amount of white on the flippers varies, sometimes the central patch being absent. Again in *E. minor novaehollandiae* there are often white feathers in the tail.

Distribution. Banks Peninsula where it breeds plentifully all round the coast. It is not known to breed elsewhere but it has been observed north of Auckland, Lyall Bay, Cape Farewell, Chetwode Islands, Tory Channel, Motunau Island, Moeraki, Otago Peninsula and South Brighton.

Ecology. The White-flippered Penguin inhabits the rocky coast of Banks Peninsula. Probably it does not go far in the non-breeding season though solitary birds have

Banks Peninsula *H. Guthrie-Smith*
WHITE-FLIPPERED PENGUIN

been seen in near and distant localities both north and south.

Regarding the movement of White-flippered Penguins through the water O'Brien says: "The feet are used as a means of propulsion only when travelling slowly. The flippers are used exclusively at speed, the feet being trailed out behind."

The mortality among the nestlings, according to O'Brien, is about eighty per cent., due to the attacks of fleas. This shocking state of affairs is described by O'Brien in the following words: "As soon as the chicks hatch, countless fleas and ticks appear. They attack both parent birds and young, but concentrate chiefly on the chicks. The particular flea has been identified by the Cawthron Institute as *Parapsyllus australiacus*, and the tick as *Ixodes eudyptidis*. It seems possible, owing to the fact that such large numbers of parasites attack the newly-hatched chicks, which are consequently in a very weak condition, that this onslaught proves too much for their vitality. Only in the case where a chick is exceptionally strong does it appear to survive the ordeal. The weaker ones rapidly become emaciated and die. The corpses then become good feeding ground for the next batch of flea larvae, . . . At the end of the nesting season the remaining larvae pupate and apparently lie dormant until the following year when the adult birds return to the nests, thus accounting for the sudden influx of fleas. The ticks do not appear to worry the birds to the same extent."

Food. "Small fish form the principal article of food. They are taken some distance out at sea, or in the neighbourhood of the kelp beds lining the shore, and are swallowed under water." (O'Brien.)

Nesting. The White-flippered Penguin breeds on rocky coasts not far above high water mark. It may select a cave, or find a nesting site in the spaces between the rocks of talus, or it may find a burrow or partly excavate one on the slopes above the rocks on the shore. The nest may be nothing more than a hollow in the floor of the nesting hole with or without a little grass. Sometimes quite a good nest is made of sticks, ice-plant stems and dried seaweed with a lining of grass. The eggs are laid in September and October. The earliest date on which I have found eggs is September 9th. The incubation period was determined by O'Brien as 38 days during which time the female sits about 21 hours out of 24, the male relieving her in the early hours of the morning. After the young depart, states O'Brien, the adults return to moult, remaining on shore for the period, ten to fourteen days, required for the process.

References.—Finsch., Proc. Zool. Soc., 1874, p. 207 (*E. albosignata*, Akaroa Heads). Potts, Trans. N.Z. Inst., 2, 75, 1870. Guthrie-Smith, Sorr. Joys N.Z. Nat., 140, 1936. Mathews, Suppl. Birds Lord Howe Norf. Is., 75, col. pl. 1936. O'Brien, Rec. Cant. Mus., 4, 311, 1940. Richdale, Emu, 40, 206, 1940.

ORDER PODICIPEDIFORMES

GREBES

Bill straight, pointed. Toes with broad lateral webs. The grebes have bills somewhat resembling those of the rails, and the toes are lobed in a way that recalls the coots. It is evident, therefore, that lobed toes have been developed independently in the coots, grebes, and phalaropes in relation to their swimming habits.

FAMILY PODICIPEDIDAE

Bill compressed, nasal grooves deep. Wings short, rounded. No tail. Feet placed far back. Webbing of toes spatulate, not scalloped; middle claw broad and short.

In both the coots and phalaropes the webbing on the toes is scalloped, regularly in coots, less regularly in phalaropes.

Only one genus is admitted in this family as the characters of the grebes and dabchicks are essentially similar. There are, however, considerable differences in the skulls of the large and small species.

GENUS PODICEPS

Bill short or long, straight, sharp-pointed; nostrils in a depression at the base of the upper mandible; lower mandible grooved near base. Secondaries about the same length as the primaries. Toes lobed, united at base.

There are about twenty species of grebes distributed over the whole world.

Key to New Zealand Species

Large: bill 60 mm. head crested	*P. cristatus*
Small bill 25 mm. head not crested	*P. rufopectus*

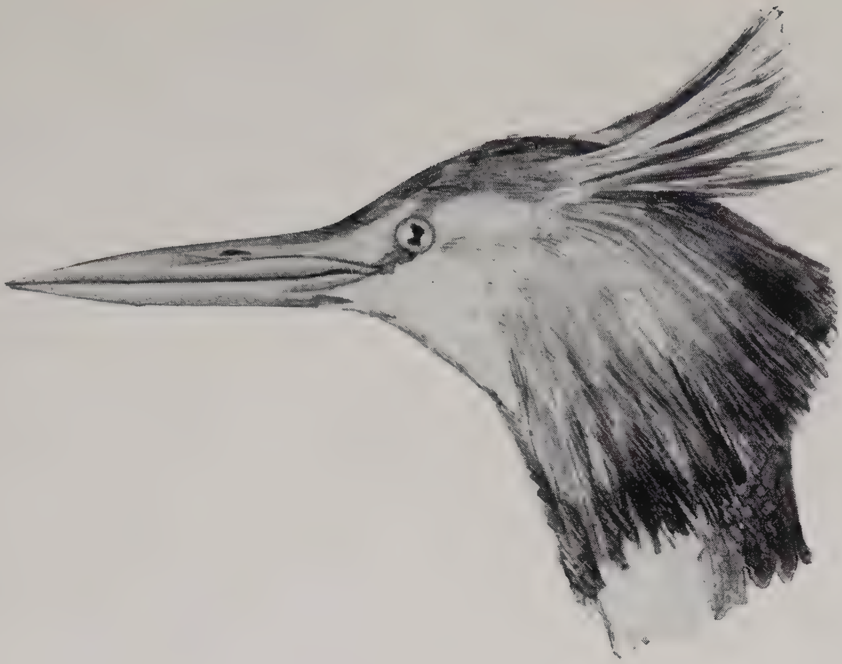
References.—Latham, Gen. Syn. Suppl., 1, 294, 1787 (*Podiceps,* type *Colymbus cristatus* L.). Selby, Cat. Gen. Type Aves., 47, 1840 (*Poliocephalus,* type *Podiceps poliocephalus,* Jard and Selb.).

Crested Grebe. Puteketeke

Podiceps cristatus australis

In 1844 Gould described a Crested Grebe which he stated came from Van Diemens Land, but which Mathews in his *Birds of Australia* says, according to the description, must have been from New Zealand. If this is so then this bird was, as far as can be ascertained the first to be collected in New Zealand. Potts, who seemed to miss nothing in the way of bird life in Canterbury, found the Crested Grebe on Lake Selfe as early as 1856, and, when exploring in the Otago District about 1862, Dr. Hector obtained several specimens of this grebe.

Adult. Upper surface including crest blackish brown slightly glossed with green; primaries greyish brown, with webs stained and tipped with rufous, and black shafts; secondaries white, except the outermost ones which are black on their exposed webs and stained with rufous; outer wing coverts greyish brown, secondary coverts black; marginal coverts white; streak in front of eye, throat, sides of head and lower part of foreneck fulvous white; black band from gape through eye; ruff chestnut with black border. Under parts of body silvery white, stained deeply on the sides of the breast and slightly in front with chestnut. Bill dark brown, lower edge and tip of lower mandible yellow. Iris red. Feet olive green, under surface pale yellow, claws greenish black. Bill 56-60, wing 190-200, tarsus 65-70, outer toe 76-82 mm. *Immature.* Crest and ruff absent. Forehead and top of head brownish black flecked with white; sides of face and throat white, a brown band from the gape through the eye; hind neck and upper surface brown; primaries brown, secondaries white; lower surface silvery white. A brownish black crest develops later followed



E. H. Atkinson

CRESTED GREBE

by the ruff. *Nestling.* Covered with soft down. Upper surface buff with longitudinal stripes of brownish black; on the hind neck the stripes are narrower, darker and somewhat broken; on the sides of the crown they spread out into broad patches. A narrow irregular stripe of black on each wing. Under surface white. Bill blackish brown with a horny tip. Feet greenish brown.

Eggs. Clutch three or four, pointed at both ends, pale bluish with chalky layer, 57.5 x 37, 56.5 x 35.5 mm.

Status. Four subspecies each inhabiting one of the land masses of the eastern hemisphere have been recognised. The New Zealand subspecies (*P. c. australis*) is distinguished by its large size, darker coloration and no white line above eye, and the Australian subspecies (*P. c. christiani*) by its small size and lighter coloration when compared with the typical subspecies (*P. c. cristatus*) of Europe. There is a subspecies, *P. c. infuscatus,* in Africa.

Distribution. North Island: Formerly on the Waikaremoana and Waikareiti Lakes in the Urewera County. South Island, on lakes throughout. Most common in Westland, rare in eastern Marlborough and Canterbury though visitors to the east coast occasionally reported.

Range of the species: Australia, Tasmania, Europe, Asia, Africa.

Habitat. The Crested Grebe inhabits the inland lakes feeding along the shore, but on being alarmed it moves quickly out to the centre where it soon becomes lost in the expanse of water. It swims low in the water and is an expert diver, being able to remain under the water for a considerable time.

Nesting. Describing the nesting habits of the Crested Grebe, Potts states: "We have found the nest in November and December. The structure is large and very solidly built of pieces of decayed *Carex virgata,* raised about a foot above the level of the water; its sloping sides give a ready means of reaching the basin-like depression on the top in which the eggs are deposited. In several instances we have observed that the nest had been constructed on the top of an old stump of *Carex virgata* situated in a shallow part of the lake, distant from twenty to one hundred yards from the shore. During incubation the Grebe maintains an upright posture, with its long graceful neck held erect, so motionless in attitude, that at a distance it rather resembles a stick than anything endued with life. Watchful and shy, it noiselessly dives, immediately it discovers itself observed."

On Lake Guyon, Travers states that "the nests are built amongst the twiggy branches of trees which have fallen from the banks of the lake, and now lie half floating in its waters, and are formed of irregularly laid masses of various species of pond weeds, chiefly of Potamogeton found growing in the lake, and which the birds obtain by diving. . . . Both the male and female Grebe assist in the labour of incubation. Before the actual work of incubation commences the eggs are usually covered with pond weed during the absence of the birds from the nest. . . . The young birds take to the water immediately after being excluded from the egg. When fatigued they are carried on the backs of the old birds, taking their station immediately behind the insertion of the wings."

According to Stead the Crested Grebe builds a floating nest of grasses and rushes where it can find a suitable anchorage among reeds or branches, but sometimes builds on land under overhanging cover near the water. He states that on account of floating nests being nearly always wet it is seldom that the full brood is reared.

Mrs. Moncrieff has supplied me with the following information. A nest found by Mr. C. Flower at Lake Rotoroa in 1927 was placed under a totara tree by the side of the lake. When a fairly high flood came the nest rose until the branches of the tree stopped it. The four eggs were washed out and no more were laid that season. The same pair of grebe, in 1928, built a nest in rushes. It was constructed of weed brought from the floor of the lake, and stood eighteen inches in height.

E. F. Stead

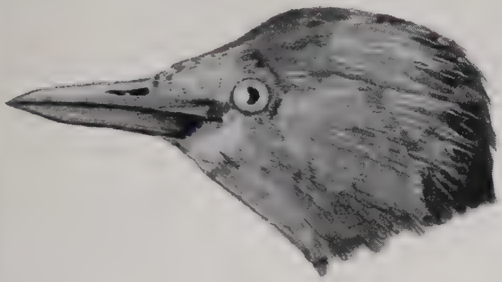
CRESTED GREBE AND NEST

During the Canterbury Museum's expedition to the South Arm of Lake Te Anau in 1953 an opportunity was afforded of watching the nesting of the Crested Grebe. Mr. R. V. Francis Smith describes what he saw as follows: After pairing off, the birds experience a gradual heightening of tension within a period of a few days. By far the commonest display is that of head-shaking while facing each other in the water, and this is accompanied by the raising of the ruff of feathers about the throat and head and excited gurgling chatter from both. When the excitement reaches a higher pitch they rise almost vertically in the water, breast to breast and bill to bill.

The nest at Lake Te Anau was a floating platform anchored to the submerged branches of a tree and was built of waterweed, myriophyllum, plus a few leaves which had blown into the lake. In the top is a shallow, basin-like depression, the bottom of which is often little above the water level with the result that the eggs are often wet. Three or four eggs is the usual clutch; they are greenish white in colour but, due to the decaying vegetation in which they rest, soon become discoloured. The task of incubation is undertaken by both parents in turn, first almost half-hourly but gradually working up to about two-hourly shifts.

When the young grebes are hatched they are covered with striped down and can swim and dive almost straight away. An amusing habit the chicks have when they feel tired is to disappear under the mother's wing. A moment later a little grey head appears from among the feathers of the parent's back from where it can watch all that is going on.

References.—Linne, Syst. Nat., 10th ed., 135, 1758 (*Colymbus cristatus*, Sweden). Gould, Proc. Zool. Soc., 1844, p. 135 (*P. australis*). Buller, Essay Orn., N.Z., 19, 1865 (*P. hectori*, Otago); Birds N.Z., 353, 1873; 2nd ed., 2, 283, 1888. Potts, Trans. N.Z. Inst., 2, 74, 1870. Travers, Trans. N.Z. Inst., 3, 113, 1871.



E. H. Atkinson

DABCHICK

New Zealand Dabchick. Weweia

Podiceps rufopectus

The first specimen of the New Zealand Dabchick that came into the hands of ornithologists was collected by Dr. A. Sinclair and forwarded to the British Museum. It was described by Gray as a new species in Dieffenbach's *Travels in New Zealand*, 1843. Two specimens, from Taieri and Waimate in the South Island, were brought home by the Antarctic expedition under Sir James Ross which visited New Zealand in 1840. Another specimen, which should be mentioned in dealing with the history of the discovery of this species, is that which was given to Colenso when on the Waikato River below Ngaruawahia and was by him mistaken for a coot and described as a new species (*Fulica nova-zealandiae*).

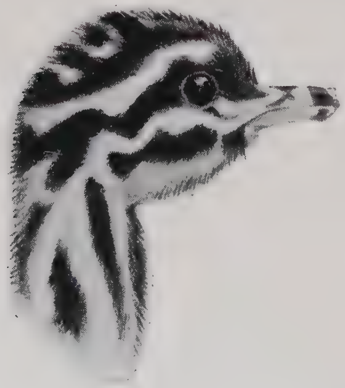
Adult. Top of head black glossed with green with white hair-like filaments formed by the elongated shafts of the feathers; remainder of upper surface dark olive-green, the feathers margined on the back with paler brown and glossed with green. Sides of head, throat and foreneck dusky brown, the cheeks pencilled with white; upper part of breast reddish brown, remainder of under surface silvery white, stained at the sides with dusky brown; under surface of wing mostly white. Bill bluish grey, black on the culmen. Iris pale yellow. Feet dark olive, inner tarsus and upper surface of toes variegated with greenish yellow, soles brown, claws pale blue. Bill 20-26, wing 120-128, tarsus 36-40, outer toe 53-55 mm. *Immature.* Head black, variegated on the crown with bright ferruginous, and marked on the sides with two broad streaks of buffy white; throat and neck yellowish buff streaked with black; upper parts and sides of body dusky mottled with fulvous; breast and abdomen buffy white. Bill dark brown with a black bar across the middle and another near the tip. *Nestling.* Covered with short thick down, variegated jet black and buff, but rufous instead of buff on top of head, pale rufous on foreneck and white on chin, throat and face below the eye. Abdomen white without black markings. The black is disposed in broad bands and blotches. On the side of the head is a broad black band from forehead through upper part of eye to nape, another above it and a third below it beginning under the gape. Two curved bands, convexity towards the midline, on either side of the front of the neck in the region of the pale rufous patch. Two transverse blackish bands on the bill. *Colour varieties.* An albino has been described by Buller. General plumage white; top of head and hind neck streaked and spotted with black; wing dusky black varied with white; sides of head and throat shaded with brown; foreneck and breast varied with pale rufous.

Eggs Clutch two, sometimes one or three, elliptic, pointed both ends, roughened with scattered pimples, bluish white but soon staining from contact with nest and bird. Clutch of three eggs, Lake Rotoiti, 43.5 x 29.5, 44.5 x 29.6, 43.5 x 29.3 mm. (Buddle).

Status. Very closely related to the Australian *P. poliocephalus* but the New Zealand bird has the back darker, the breast chestnut instead of buff, and there is less black on the head. These two species comprise the subgenus *Poliocephalus.*

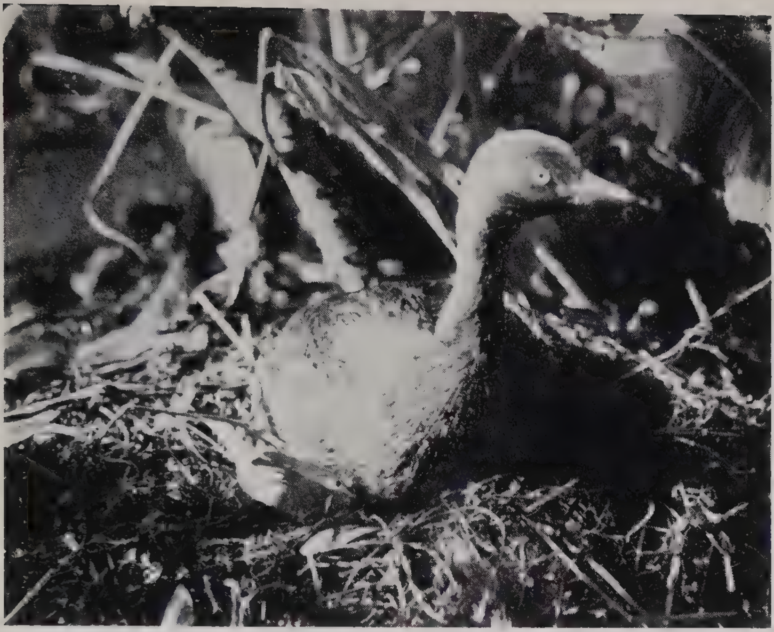
Distribution. Generally distributed throughout the North and South Islands, not uncommon but easily overlooked. It is common in lakes, in sand dunes along the west coast of North Auckland, and is present in similar situations from Wanganui to Otaki. Abundant in all the lakes in the Rotorua district, Lake Taupo, Lake Waikaremoana, Tutira Lake, southward to Lake Wairarapa. In the South Island mainly on the western side as far south as Lake Hauroko, near Foveaux Strait. Least common in Canterbury and East Otago, from where it has no doubt almost disappeared through the advance of settlement.

Habitat. The Dabchick is not uncommon in many parts of New Zealand in lakes, lagoons, swamps and creeks. It feeds in the shallow water near shore and on the slightest alarm swims out into the centre of the lake or across to the other side. Thus when approaching a lake usually one's first view is of the birds swimming quickly away from the shore. Yet even this timid bird is amenable to friendliness towards man. On a small bush-enclosed lake, called Wombat Lake, near the Franz Josef Glacier, the Dabchicks swim towards, not away from, visitors because they are used to receiving food from the visitors' lunch baskets. The Dabchick is seen in pairs during its extended breeding season, but in the winter it associates in small flocks. The ever widening area of settlement by Europeans, with the accompanying draining of swamps, has resulted in the disappearance of the Dabchick from many localities. However, Mr. Stidolph informs me that in the Wairarapa district the Dabchick has appeared in dams in pastoral areas many miles from any known habitat and has bred successfully, showing that it is capable of colonising any suitable waters.


R. Jacobs
NESTLING DABCHICK

Food. The Dabchick seeks its food, which consists largely of insects and freshwater mollusca, among sedges and waterweeds growing in shallow water.

Nesting. Major G. A. Buddle has observed the breeding habits of this bird and I am entirely indebted to his account for the following information. The investigation was made at Lake Rotoiti in the Rotorua district. Pairing begins about August and breeding is continuous until May. Five or six clutches of eggs may be laid during the season but owing to the position of the nests only one or at most two broods are reared. "The nest is either floating, anchored to overhanging branches or rushes, or sometimes on a solid ledge or platform not more than three or four inches above water level . . . in such a position that the bird can approach or leave the nest under water without being seen. The nest is a flimsy, clumsily-built but bulky structure, and a very small amount of wave action is sufficient to disintegrate it completely." Nests were found among vegetation along the lake edge including musk, rushes, raupo, niggerheads, ferns and branches of willow trees. One nest in a clump of rushes "was in use throughout the season, and had been constantly built



Ohau Channel, Rotorua *G. A. Buddle*

DABCHICK

on and added to until the base of it had been forced down to the bottom, a matter of at least three feet. The nests are built entirely of water-logged material brought up from the bottom, chiefly raupo, small branches and twigs and a few leaves. Both male and female assist in nest-building . . . material is usually collected twenty or thirty yards away from the nest, brought to the surface and examined. If it be satisfactory the bird dives and swims under water to the nesting site. . . . The young leave the nest immediately after hatching". Many other interesting facts about these curious looking birds are given by Major Buddle.

References.—Gray, Dieff., Travels N.Z., 2, 119, 1843 (*P. rufopectus*, New Zealand). Colenso, Tas, Journ. Sci., 2, 283, 1845 (*Fulica novae zealandiae,* Waikato River). Gray, Zool., Erebus and Terror, Birds, 16, col. pl. 1845. Potts, Trans. N.Z. Inst., 3, 105, 1871. Buller, Birds N.Z., 350, 1873; 2nd ed., 2, 280, 1888. Buddle Emu, 39, 77, 1939.

ORDER PROCELLARIIFORMES

PETRELS

Bill strongly hooked at the tip, covered with separate horny plates; nostrils in tubes. Front toes fully webbed; hind toe absent or very small. Young covered with down, helpless.

Key to Families

Nostrils on the culminal ridge.	
Plane of nasal opening horizontal. No hind toe	*Pelecanoididae*
Plane of nasal openings vertical or oblique. Hind toe present.	
Nasal opening in single tube	*Hydrobatidae*
Nasal opening divided by a septum	*Procellariidae*
Nostrils lateral, separated by the culminicorn	*Diomedeidae*

FAMILY PELECANOIDIDAE. DIVING PETRELS

Bill with the nostrils separate and opening directly upwards, the plane of the opening being horizontal, internasal septum with paraseptal processes. No hind toe.

A single genus in the Southern Hemisphere.

Genus Pelecanoides

Bill with the nostrils distinct, opening upwards on either side of the median line of the base of the culmen. Wings short; first primary longest.

The Diving Petrels are easily recognised by their peculiar bill characters, and when on the wing by the small size, black colour above, white below, and the flight which consists of a few rapid flaps of the wing followed by sailing. They always fly near the surface of the water.

Four species are here recognised in the cold and temperate seas of the Southern Hemisphere, one species extending into the tropics on the west coast of South America.

Key to New Zealand Species

Bill parallel-sided; paraseptal process at posterior end of nostril	*P. urinatrix*
Bill tapering; paraseptal process near middle of nostril	*P. georgicus*

References.—Lacepede, Tabl. Ois., 13, 1799 (*Pelecanoides,* type *Procellaria urinatrix*, Gmel.) Murphy and Harper, Bull. Am. Mus. Nat. Hist., 44, 495, 1921.

Diving Petrel. Kuaka

Pelecanoides urinatrix urinatrix

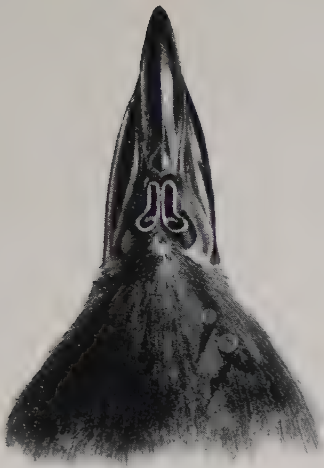
The Diving Petrel was discovered at Queen Charlotte Sound in 1773 during Cook's second voyage. From a drawing by G. Forster, one of the naturalists of this expedition, Latham described the "Diving Petrel" and Gmelin founded the specific name *urinatrix*.

Adult. Bill with base nearly parallel-sided, apex tapering abruptly to the tip. Anterior end of paraseptal process at posterior end of nostril. Upper surface glossy black, the secondaries, some scapulars and the coverts on the wing flexure edged with white; sides of neck pale grey the feathers tipped with white. Under surface white. Bill black, the lower edges of both mandibles purplish. Feet cobalt blue, webs darker. Bill 15.5-17, wing 112-133, tail 35-41, tarsus 24-28, mid toe 29-35 mm.

Nestling. At first covered with silvery grey down above, white below. Second down dark brownish grey above, sooty grey below.

Eggs. Clutch one, oval to nearly round, slightly pointed at one end, white, 36 x 29.6, 36.7 x 28 mm. Stephen Island.

Status. The species *urinatrix* differs from *georgicus* in the mandibular rami being parallel or nearly so, and in the posterior position of the paraseptal process. Of the



Lily A. Daff

DIVING PETREL

three subspecies found in the New Zealand region, the typical one, *P. u. urinatrix,* has the rami parallel and at the apex abruptly tapering. In *P. u. chathamensis* the interramal space is narrower and the bill not so deep. In *P. u. exsul* the rami are slightly arched.

Distribution. Common round the North and South Islands and Stewart Island, breeding at the Three Kings Islands, Cavalli Islands, Poor Knights, Mokohinau group, Bream Rock, Sail Rock, Chicken Islands, Little Tiri, Horuhoru, Saddle Island, Little Barrier Island, Channel Island, False Watchman, Aldermans, Rabbit Island, Plate Island, Karewa, Stephen Island, Brothers, Trio Islands. Australia. Tasmania.

Nesting. At Mokohinau the Diving Petrel is described by Sandager as breeding on the smaller islands where it forms its burrows in the light soil. Burrowing commences in April, and in July a nest consisting of flax, sticks and grass is formed at the end of the burrow. A few birds lay towards the end of July but most lay during August. Previous to laying the birds are seldom found in their burrows during the day, all the work of burrowing being carried out at night. Only one egg is laid in each nest. On Karewa Island in the Bay of Plenty Sladden found eggs of the kuaka in August. In the north of New Zealand Falla records the months of arrival for breeding as April and May, and that for the young leaving about the end of November. These dates are considerably earlier than those recorded by Richdale for *P. u. chathamenses* on the islets off Stewart Island.

References.—Gmelin, Syst. Nat., 560, 1789 (*Procellaria urinatrix,* Queen Charlotte Sound). Buller, Birds N.Z. 313, 314, 1873; 2nd ed., 2, 207, 208, 1888. Godman, Monogr. Petrels, 299, 304, Col.pl. 1909. Murphy and Harper, Bull. Am. Mus. Nat. Hist., 44, 533, 1921. Falla, Rec. Auck. Mus., 1, 246, 1934.

Chatham Island Diving Petrel

Pelecanoides urinatrix chathamensis

This subspecies was first discovered in the Chatham Islands by H. H. Travers in 1871. Travers said that it was common on Pitt Island and was occasionally found on Mangere. Hutton described Travers' specimens and, referring them to *Halodroma berardi,* said that the narrow bill easily distinguishes them from *H. urinatrix.* Forbes found the Diving Petrel on Pitt Island in 1890 and collected eggs. There is no further record from either Pitt or Mangere Islands so presumably it has been destroyed by cats. In 1937 C. A. Fleming found it breeding on Southeast Island.

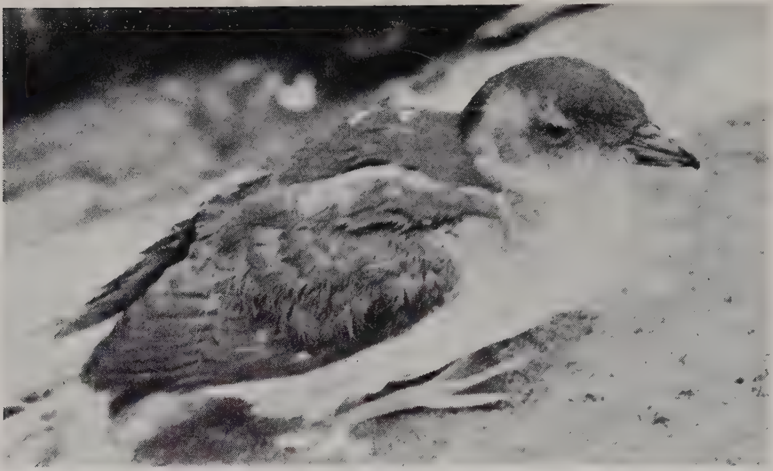
Reischek recorded Diving Petrels at Dusky Sound in 1885, and in 1888 collected them at the Snares Islands.

Adult. Colour as in the typical subspecies, *P. u. urinatrix,* but the jugulum not so distinctly grey. The interramal space is narrower and the bill not so deep. Size smaller than *P. u. urinatrix.* Bill 14-17, width of bill 7-8, wing 110-133, tail 34-41, tarsus 23-26, mid toe 29-37 mm. *Immature.* Plumage fresh and glossy with pronounced white tips to the secondaries. Bill not wider than 6.5 mm. (Fleming). *Nestling.* Second downy stages dark silver grey on upper surface, much lighter on under surface.

Eggs. 35.6 x 29.2, 36.7 x 28 mm. Pitt Island.

Distribution. Chatham Islands, islands off Stewart Island. Solander and Snares Islands, breeding.

Habitat. The Diving Petrel occurs in immense numbers along the southern



L. E. Richdale

DIVING PETREL

coast of New Zealand. It is to be met with just offshore in large flocks and when disturbed by a passing steamer flies close to the surface of the water with alternate rapid wing flapping and sailing, to settle or dive after a comparatively short distance. It comes ashore on small islets off the coast breeding in immense numbers together. Their nightly landing has thus been described by Guthrie-Smith on a small island called Herekopere off Stewart Island: "About seven the earliest of the Kuaka began to arrive; at first here a bird and there a bird; then almost at once it began to hail kuaka, then to sleet kuaka, and lastly to snow kuaka. They reached the island in dozens, scores, hundreds, thousands, hundreds of thousands, and I verily believe in millions. At first they hurtled themselves in like hailstones, then later fell with some degree of regard for their safety, and lastly lit softly as snow and with hardly a rustle. The kuaka never circles or hesitates, but always flies very fast and straight in from the sea, but the final drop is vertical." Richdale visiting the same island about thirty years later found comparatively few birds compared with those seen by Guthrie-Smith, this being the result of the introduction of cats to Herekopere.

In the Stewart Island region Diving Petrels are taken in large numbers by skuas.

Food. The principal food of the Diving Petrel seems to be pelagic crustaceans of the group of Euphausids. These are isopods from half to three-quarters of an inch in length.

Nesting. On Whero Islet Richdale found no birds in May. In August there were some birds about. The incubation period was estimated by Richdale to be eight weeks, and as he records the peak of hatchings to be between November 14th and December 3rd the peak period of egg laying should be approximately September 19th to October 8th. The date varies for in 1941 kuaka chicks hatched ten days earlier than usual. On the attainment of wing development and the reduction to normal flying weight, which, says Richdale, is on an average when the chick is 54 days old, the young birds leave the nest. The peak period for departure is the last three weeks in January.

On Whero Islet Richdale records that the majority of the burrows are in shallow soil round the edge of the island where it is dominated by Poa tussock. There are many burrows around the roots of the teteaweka (*Olearia angustifolia*). The usual length of the burrows is 18 inches and generally they turn near the end, most often to the right.

Three and a half days is taken by the chick to free itself from the egg shell. The parents change guard nightly. Because of the short down on the chick's head when hatched the parents cannot leave them uncovered for about ten days. The chicks may not always fly the night they leave the burrows. They have been seen one or two days afterwards.

The operation of the chicks being fed by the parents is thus described by Richdale: "The parent, after having already, with a barely perceptible cough, brought the food up part of the way, opens its mandibles, waits for the chick to put the point of its bill into its mouth, and then squirts forth a red cream, thick and ribbonlike, as if from a tube of tooth paste. The chick immediately takes this with the point of its bill but evidently finds the act difficult for it pushes the bill crossways so that the ribbonlike material is taken side on but with that portion of the bill close to the tip. At the same time the mandibles are vibrated rapidly to make room for the whole pieces, which appeared to be about one inch long." Richdale further observed that on most nights the two parents fed the kuaka chick.

The following account is from C. A. Fleming who, with E. G. Turbott, camped on Southeast Island, in the Chatham Group, during the latter half of December, 1937. The burrows are scattered all over the island amongst those of *Pelagodroma* which outnumber them considerably. A few chicks were almost completely clothed in silver grey down, lighter ventrally, with contour plumage only on head and wings. Well-grown fat fledglings in nearly complete teleoptyle plumage occupied most of the burrows. Down still adhered to portions of the body in most of the birds though a large number had lost all the down.

References.—Murphy and Harper, Bull. Amer. Mus. Nat. Hist., 35, 65, 1916 (*P.u. chathamensis*, Chatham Is.); 44, 537, 1921. Fleming, Emu, 38, 407, 1939. Richdale, Emu, 43, pp. 24, 97, 1943; Trans. Roy. Soc. N.Z., 75, 42, 1945.

Kerguelen Diving Petrel

Pelecanoides urinatrix exsul

Most of the records of Diving Petrels under the name *P. exsul* as having been taken in New Zealand do not refer to this subspecies. It was collected at the Auckland Islands in 1840 by the naturalists of the *Erebus* and *Terror* expedition. The species was found breeding on the islets in Port Ross, Auckland Islands, by the ornithologists attached to the military expedition stationed on these islands during the war of 1939-1945.

Adult. Paraseptal process posterior to the centre of the septum and not prominently developed. Mandibular rami slightly arched, the tips of the gnathidea in contact in front. Upper surface glossy black; anterior part of forehead and lores suffused with brown; scapulars deep neutral grey with a whitish terminal bar; inner webs of primaries brown; secondaries narrowly tipped with whitish; tips of tail feathers whitish. Sides of neck and breast deep neutral grey, the feathers tipped with white, the mottling usually extending across the jugulum; remainder of under surface white. Bill black, lavender blue at base of lower mandible. Iris ash colour, not visible in the living bird. Feet lavender blue. Bill 15-17, width 8-9, wing 119-125, tail 38-42, tarsus 23.5-26, mid toe 31-35 mm. Kerguelen.

Nestling. Upper surface covered with pale silver grey down, under surface white. Following this stage is a second downy stage of a dark sooty grey colour, lighter and more ashy below. Traces of the silvery down are found for a little while after the second stage appears.

Eggs. Clutch one, ellipsoidal, white, 40.6 x 32.6, 38.2 x 32.2 mm. Auckland Islands.

Status. Differs from *P. urinatrix* in the characters of the bill as above described and in their being more grey on the jugulum.

Distribution. Auckland and Antipodes Islands, breeding. Campbell Island. Tauranga, one specimen.

Kerguelen, Heard and Marion Islands in the South Indian Ocean breeding.

Habits. The Kerguelen Diving Petrel is found in the seas just south of the northern limit of drift ice. It is thus in a climatic zone south of that occupied by *P. u. urinatrix.* In the Auckland Islands it overlaps the distribution area of *P. georgicus.* The Kerguelen Diving Petrel is exceedingly abundant on Kerguelen Island. It nests in burrows under the dense cushions of the umbelliferous plant *Azorella selago.* According to the naturalists of the *Challenger,* Mosely and others, it is to be seen on the surface of the water in Royal Sound in very large flocks. "These Petrels dive with extreme rapidity, and when frightened, rise, flutter along close to the water, and drop and dive again; it is a curious sight to see a whole flock thus taking flight. The birds breed in enormous quantities on the islands in Royal Sound."

References.—Salvin, Cat. Birds Brit. Mus., 25, 438, 1896 (*P. exsul,* Kerguelen Island). Godman, Monogr. Petrels, 304, col. pl. 1909. Murphy and Harper, Bull. Am. Mus. Nat. Hist., 44, 544, 1921.

South Georgian Diving Petrel

Pelecanoides georgica

The recognition of this species of diving petrel is due to the researches of R. C. Murphy who collected large numbers of specimens in South Georgia in 1913. When describing the species later he recognised in the Tring Museum two specimens that had been collected at Macquarie Island in 1899. In 1943 Falla found the species breeding at the Auckland Islands.

Adult. Bill relatively broad, the sides tapering from base to tip. Anterior end of paraseptal process in middle of nostril. Upper surface glossy black; scapulars greyish white tipped with grey, secondaries edged with whitish. Under surface white with more or less grey mottling across the fore-neck. "Bill black, rami of mandible bluish. Iris brown. Bill blue tinged with lavender, webs dark grey. Bill 14.5-16, wing 110-125, tail 40-43, tarsus 23-25, mid toe 29-33 mm. Kerguelen." (Falla.) *Nestling.* Covered with grey down, paler on the under surface.

Eggs. Clutch one, broad oval, white, smooth, pitted. 38.5 x 32.1, 38.9 x 32.5, 40 x 31 mm. Kerguelen. (Falla.)

Status. Size and colour of the Chatham Island Diving Petrel and only distinguished by the characters of the bill.

Distribution. Auckland and Macquarie Islands, breeding. South Atlantic and South Indian Oceans. Breeding at South Georgia, Heard and Kerguelen Islands.

Habits.—At South Georgia, Diving Petrels were observed by members of the German Transit of Venus expedition throughout the year, though doubtless most of them spend the winter in the neighbouring seas. Their breeding ground has been described by Murphy who states that they excavate, entirely at night, long burrows through hard, stony, often frozen soil. The nest chambers are unlined except for a little down and an occasional piece of lichen. The nesting season extends from November to March.

References.—Murphy and Harper, Bull, Am. Mus. Nat. Hist., 35, 66 1916 (*Pelecanoides georgica* South Georgia); 44, 519, 1921.

FAMILY HYDROBATIDAE
STORM PETRELS

Bill slender, the nostril tubes united into a single opening, the septum not reaching the aperture. Tarsi reticulate, scutellate, or booted.

Key to New Zealand Genera

Secondaries 13 or more. Tarsus less than twice culmen.
  Subfamily Hydrobatinae, Short-legged Storm Petrels .... *Oceanodroma*
Secondaries 10. Tarsus more than twice culmen.
  Subfamily Oceanitinae, Long-legged Storm Petrels.
    Basal joint of middle toe normal, less than remaining joints and claw.
      Bill short (12 mm). Tarsi booted. Claws narrow .... *Oceanites*

Bill short (12 mm). Tarsi scutellate. Claws narrow .... *Garrodia*
Bill long (18 mm). Tarsi scutellate. Claws flattened .... *Pelagodroma*
Basal joint of middle toe flattened, equal to or longer than remaining joints and claw .... *Fregetta*

GENUS OCEANODROMA

Tail perceptibly forked. Tarsus not longer than middle toe and claw, covered in front with hexagonal scutes; claws sharp and compressed.

About eleven species distributed over the seas of the world. The forked tail in conjunction with the comparatively short legs mark off this genus from all other Storm Petrels.

References.—Reichenbach, Syst. Av., p. iv, 1852 (*Oceanodroma*, type *O. furcata*). Salvin, Cat. Birds Br. Mus., 25, 347, 1896.

Fork-tailed Storm Petrel

Oceanodroma leucorhoa leucorhoa

One specimen only of this Storm Petrel has been obtained in New Zealand. A dead male bird damaged by sand lice was found on the Muriwai beach, west of Auckland, by Dr. R. A. Falla in August, 1922.

Adult. Sooty brown with a gloss of slaty grey; lesser wing coverts black, greater coverts and inner secondaries narrowly fringed with white; primaries and their coverts black; lower rump with some more or less white feathers on each side; upper tail coverts white with dusky shafts; tail black. Under surface slightly browner than upper surface, with a distinct shade of slaty grey on the throat, sides of face and sides of neck; a few feathers on lower flanks adjoining white rump with outer webs and sometimes tips white. Inside mouth deep pink. Bill and feet black. Bill 16, wing 154, tail 78, fork of tail 21, tarsus 25.4 mm. St. Kilda, Scotland. New Zealand specimen: Bill 15, wing 160, tail 82, fork of tail 12, tarsus 23.5, mid toe 25 mm. *Nestling.* Covered with long woolly sooty brown down.

Status. The New Zealand specimen is referred to the typical subspecies, *O. l. leucorhoa*, of the North Atlantic and North Pacific Oceans. Two subspecies of smaller size, *O. l. beali* and *O. l. koedingi*, are found in the eastern North Pacific.

Eggs. Clutch one, elliptical to oval, white, minutely speckled with reddish dots at the larger end, length 30.2-35.3, breadth 22.4-25.4 mm.

Distribution. Muriwai Beach, one occurrence. *O. l. leucorhoa* breeds on both sides of the North Atlantic and on the western side of the North Pacific south to Japan.

Habits. The food of this Storm Petrel consists of pelagic animals of various kinds: euphausid and copepod crustacea, mollusca, including squids, small fish. It nests in burrows on islets off the coasts of the British Isles and elsewhere. The nest chamber is sometimes lined with grass, roots and lichens. Incubation is by both sexes in alternate spells of about three days.

References.—Vieillot, Nouv. Dict. Hist. Nat., 25, 422, 1817 (*Procellaria leucorhoa*, France). Godman, Monogr. Petrels, 8, 1907. Witherby and others, Handb. Br. Birds, 4, 29, col. fig., 1948.

GENUS OCEANITES

Bill short, the nasal tubes reaching half the length of the culmen. Tail slightly emarginate. Tarsi booted, claws not much flattened.

Oceanites is closely related to Garrodia, but is distinguished from that genus by the booted tarsi and emarginate tail.

Two species are included: one is nearly world wide in distribution, the other, *O. gracilis*, inhabits the western coast of South America. The New Zealand *O. maoriana* is also tentatively placed here as a third species.

References.—Keyserling and Blasius, Wirb. Europas, 93, 1840 (*Oceanites*, type *Procellaria oceanica*, Kuhl.)

Wilsons Storm Petrel

Oceanites oceanicus exasperatus

Wilsons Storm Petrel was included as a New Zealand species without locality in Buller's *Birds of New Zealand* 1888. Five specimens have since been obtained from various localities in New Zealand.

Adult. Sooty black, paler on the greater wing coverts. Upper tail coverts and patch on lower flanks white. Under tail coverts whitish at base, sooty black at tips. Bill black. Iris dark brown. Feet black, middle of webs yellow. Bill 11-13, wing 146-159, tail 63-74, tarsus 32-35, mid toe 25-28 mm. Cape Denison (Falla).

Eggs. Clutch one, elongated oval, white with reddish brown dots mostly at one end, 33 x 23 mm.

Status. Three subspecies are recognised. *O. o. oceanicus* Atlantic Ocean. *O. o. chilensis,* with shorter wing, tail and culmen. West and south coasts of South America.

Distribution. Stragglers only on coast of New Zealand, Muriwai, Tauranga, Patearoa, Hamilton, Gisborne, New Plymouth. There are sight records from Whangarei and off East Cape. Wilson states that this species was observed from the *Discovery* from the Antarctic pack ice as far north as Macquarie Island.

Antarctic continent, breeding at Cape Adare, Cape Denison and other places, to Australian and New Zealand seas.

References.—Kuhl, Beitr. Zool. Verge. Anat., 136, 1820 (*Procellaria oceanica,* South Atlantic). Buller, Birds N.Z., 2nd ed., 2, 250, 1888. Godman, Monogr. Petrels, 41, col. pl., 1907. Mathews, Birds Austr., 2, 11, col. pl., 1912 (*O. o. exasperatus,* New Zealand Seas). Serventy, Emu, 52, 105, 1952.

New Zealand Storm Petrel

Oceanites maorianus

This storm petrel was first collected off Banks Peninsula in 1829 by the *Astrolabe* Expedition. This specimen is in the Paris Museum. A second specimen was procured in the neighbourhood of Banks Peninsula by Mr. G. Carrick Steet who presented it to the British Museum. A third, also from Banks Peninsula, is in the Paris Museum.

Adult. Tail doubly emarginate. Head, neck, breast and upper surface sooty black, darkest on the head, the upper tail coverts white. Chin white mottled with sooty black; under surface from the breast downwards white streaked with sooty brown; axillaries and greater under wing coverts whitish. Bill and feet black. Iris brown. Murphy gives the measurements of the three specimens as follows (the first is the type in the British Museum): Bill 12.5, 12.7, 12.5; wing 151.5, 147, 148; tail 64.2, 56.6, 58; tarsus 35, 35.3, 35.1; mid toe 27.2, 27.6, 27.2 mm.

Status. This species, if really distinct, is characterised by the white under parts with longitudinal stripes of sooty brown. Godman's plate shows a New Zealand bird with a doubly emarginate tail. Murphy, after examining all the specimens known that have been referred to *Pealea,* said of the three from New Zealand: "We strongly suspect that the storm petrel under discussion is a '*Pealea*' phase of *Oceanites oceanicus.*" I accept Murphy's generic disposition but as *Oceanites oceanicus* is only a straggler to New Zealand and is not known, where it is found in abundance, to produce colour varieties, for the present I treat *maorianus,* of which three very similar specimens have been taken, as a separate species.

Distribution. Banks Peninsula.

References.—Mathews, Suppl. Birds Norfolk and Lord Howe Is., 79, 1936 (*Pealeornis maoriana,* Banks Pen.) Godman, Monogr. Petrels, 57, col. pl., 1907 (*Pealea lineata*). Murphy, Amer. Mus. Nov., no. 1596, 1952.

GENUS GARRODIA

Bill short, the nasal tube half the length of the culmen. Tail square. Tarsi scutellate in front, claws a little flattened.

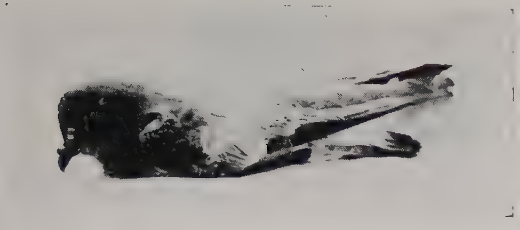
Garrodia is distinguished from Oceanites by the scutellate tarsus and square tail. It includes but a single species ranging over the entire globe except the North Pacific Ocean.

Reference.—Forbes, Proc. Zool. Soc., 1881, p. 735 (*Garrodia,* type *Thalassidroma nereis,* Gould).

Grey-backed Storm Petrel

Garrodia nereis

This species was first taken off Kaikoura during Cook's first voyage to New Zealand and was described in Solander's manuscript, part of which was published in Mathew's *Birds of Australia* in 1912. Gould took it



Arthur Pass *A. S. Wilkinson*
GREY-BACKED STORM PETREL

in Bass Strait in 1839 and founded the name *nereis* on his specimens. It was admitted to the New Zealand fauna by Gray in 1862 on the evidence of a specimen forwarded by Sir G. Grey to the British Museum.

Adult. Head, neck and upper surface greyish black; rump and tail coverts ashy grey; median wing coverts grey edged with white; some feathers on the back also edged with white. Under surface including axillaries and greater under wing coverts white. Bill and feet black. Iris dark brown. Bill 12-13, wing 125-130, tail 56-65, tarsus 30-31, mid toe 26-27 mm. (New Zealand specimens).

Eggs. Clutch one, short ellipsoid, smooth, without gloss, white with a zone of minute reddish brown spots round the larger end, 33 x 23, 32.5 x 23 mm. Chatham Islands. (Fleming.)

Distribution. Breeding on the Auckland, Antipodes and Chatham Islands (Pyramid Rock). More than twenty stragglers have been obtained from Hauraki Gulf to Foveaux Strait. It has been recorded from the Snares, Bounty and Macquarie Islands.

Nesting. On Disappointment Island, Auckland group, the burrows of this bird have been described as like rat holes. They were situated in a belt of Anisotome plants among which were sitting mollymawks. From the Chatham Islands Fleming reported as follows: On Pyramid Rock, on December 16, a single nest of this species was found in a tunnel in the overhanging succulent vegetation of *Cotula Renwicki,* which grows upon the flatter portions of the island. Here in a poorly-built nest a bird was incubating a hard-sat egg which was within a few days of hatching.

On Kerguelen Island Dr. Kidder found the nests under overhanging clumps of grass and Kerguelen tea (*Aceana adscendens*) in low swamp ground near the sea.

References.—Gould, Proc. Zool. Soc., 1840, 178, 1841 (*Thalassidroma nereis,* Bass Strait). Buller, Birds N.Z., 322, 1873; 2nd ed., 2, 247, 1888. Godman Monogr. Petrels, 50, col. pl. 1907. Mathews, Birds Austr., 2, 15, col. pl. 1912. Fleming, Emu, 38, 407, 1939.

GENUS PELAGODROMA

Bill long, the nasal tubes not reaching to the middle of the culmen. Tarsi scutellate, claws wide and flattened.

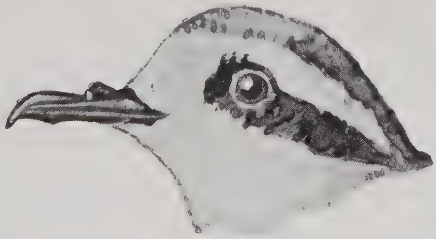
This genus comprises only one species which is distinguishable from other storm petrels by its long bill and legs. It is cosmopolitan in distribution.

Reference.—Reichenbach, Nat. Syst. Vog., 1852 (*Pelagodroma,* type *Procellaria marina,* Lath.).

New Zealand White-faced Storm Petrel

Pelagodroma marina maoriana

A specimen of the White-faced Storm Petrel was taken in the South Pacific about a thousand miles east of the Kermadec Islands during Cook's first voyage. It was described by Solander in his manuscript as having a grey rump and forked tail. This agrees with the New Zealand subspecies but as the specimen does not now exist we can never be certain of its precise identification. The New Zealand White-faced Storm Petrel was collected at the Auckland Islands in 1840 by the Antarctic Expedition under Sir James Ross. Later it was observed in New



E. H. Atkinson
WHITE-FACED STORM PETREL

Zealand and in 1871 H. H. Travers brought specimens from the Chatham Islands.

Adult. Crown dark ashy grey; a broad brownish black band extends from in front of the eye and partly below it diagonally across the side of the neck; hind neck and mantle light ashy brown; back, wing coverts and scapulars dark brown, the feathers edged with paler; rump and upper tail coverts light ashy grey; primary coverts, quills and tail brownish black. Forehead, lores, wide streak over and behind eyes, and under surface white. Under tail coverts barred grey and white. Bill black. Iris brown. Feet black, the webs yellowish. Measurements (taken by Fleming) of Chatham Islands specimens. Bill 16-17, wing 151-156, tail 69-76, tarsus 38-41, mid toe 36-37 mm. *Immature*. Differs from the adult in the upper surface being slaty grey on the head, grey on the rump, and the quill feathers of the wings and tail being black; under surface white. *Nestling*. Covered with long silver grey down, lighter on under surface, face and chin almost bare, bill black, feet grey with light yellow webs. Chatham Islands.

Eggs. Clutch one, oblong elliptical, scarcely larger at one end, white, tinged with pink when fresh, with small reddish brown specks at the larger end. 34 x 24.5, 33.5 x 24 mm. Noises Islands. 34 x 27, 36 x 25, 32 x 25 mm. Chatham Islands (Fleming). 36.2 x 27.4, 35.6 x 26.6 mm. Auckland Islands.

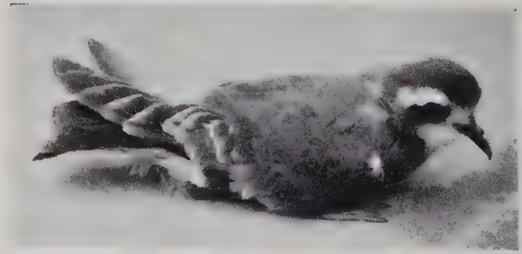
Status. Five subspecies are recognised by Murphy and Irving. *P. m. marina,* South Atlantic. According to these authors Tristan specimens in both measurements and colour pattern show close agreement with birds from New Zealand. *P. m. maoriana*, New Zealand. Besides the grey rump this subspecies is distinguished from *P. m. albiclunis* by its slightly shorter bill and middle toe, by its long and conspicuously forked tail, and by the grey brown colour of the back which extends down the sides of the breast almost meeting in front. *P. m. dulciae,* Australia. Compared with *P. m. maoriana* the tail is more square, the dimensions larger, and the white areas on face and breast more extensive. *P. m. hypoleuca,* North Atlantic. *P. m. albiclunis,* Kermadec Islands. Rump and upper tail coverts white.

Distribution. Breeding on Three Kings, Chatham and Auckland Islands; and on various islands off the coast: Poor Knights, Cavalli, Gannet Rock, Mokohinau, Noises, Mercury, Alderman, Stephen, Motunau, Tomahawk and islands off Stewart Island. Specimens have been obtained from Muriwai (west Auckland), Mayor Island, Cook Strait and Puysegur Point.

Habitat. The White-faced Storm Petrel lives at sea for about five months of the year. Nothing is known as to how far it travels from its breeding grounds during this period. The remaining seven months of the year are spent on or in the vicinity of the islands on which it breeds. These are always small islands with soil in which it can burrow.

Food. Stomachs examined by different observers have been found to contain a fine paste or a reddish oil. Remains of small crustacea have been found in the nestlings' stomachs and cuttlefish or squid beaks in those of adults. "When feeding, the petrels flit aimlessly hither and thither, alternately dipping to the water and rising again with a flick of the wings and a simultaneous pat with both feet on the surface of the water. It does not normally alight on the water." (Sladden.)

Nesting. The earliest account of the breeding habits of the White-faced Storm Petrel in New Zealand was published by Sandager. He states that on one of the low islands of the Mokohinau group it breeds in consider-



Whero Island *L. E. Richdale*

WHITE-FACED STORM PETREL

able numbers, the nests being as close together as the ground will permit. Burrowing begins during August, both male and female sharing the work, which is carried on during the daytime for a month previous to laying. A large amount of material is used for the nest. The eggs are laid during the latter half of October and the young leave the nest at the end of February. The nesting ground on the Noises was examined by myself on December 6th, 1914. The whole of the ground under the scrub was occupied by the burrows of these birds. In the various nests investigated, adult birds, fresh eggs, hard-sat eggs and young in down were found. A good many dead birds and remains of young were seen.

According to Falla, Sandager's account applies to all breeding places from the Cavalli Islands in the north to the Alderman Islands in the Bay of Plenty. The petrels appear in flocks about the middle of August, lay from about the 20th to the end of October, the young are hatched at the end of November and begin to show feathers in January. At the Noises on March 3rd two-thirds of the burrows were empty and the youngest bird found was within less than a week of flying.

The breeding cycle of birds at the Chatham Islands and on the islands off Stewart Island is about a month later than it is in the north. On Southeast Island in the Chatham group Fleming states that burrows are present in every soil-covered square yard of the 540 acres of the island whether covered with grass, nettle, fern, scrub or forest. The concentration is most apparent in the forest. Between December 16 and 31 incubating eggs were found in all stages of development from fresh to hard sat. The first nestling was found on December 21st.

Long and detailed studies of the White-faced Storm Petrel on Whero Islet, off Stewart Island, have been made by L. E. Richdale. He considers that there are no birds on the island from April to September inclusive. The burrows are found all over the island wherever there is soil, but are most plentiful in *Muehlenbeckia* and sedge areas. The burrows, seldom more than 18 inches long, have narrow entrances. The nest at the end of the burrow is well constructed, usually of fine leaves of poa grass. The normal peak of egg laying was concluded to be November 6th. The average period of incubation was determined by Richdale to be 55 or 56 days. Hatching on Whero occurs over a long period, six weeks or more, the peak being between December 22nd and January 10th. The chick does not develop two downs as with penguins and some other of the petrels. According to Richdale's observations the chicks leave the burrows fom 52 to 67 days after hatching. The peak time for leaving the island would therefore be the first half of March. Large numbers of these Storm Petrels are eaten by skuas.

References.—Latham, Index Orn., 2, 826, 1790 (*Procellaria marina* South Atlantic). Buller, Birds N.Z., 321, 1873; 2nd ed., 2, 248, 1888. Mathews, Birds Austr., 2, 24, 1912 (*Pelagodroma marina maoriana,* Chatham Islands). Fleming, Emu, 38, 405, 1939. Richdale, Trans. Roy. Soc. N.Z., 73, 97, 217, 1943; 335, 1944. Murphy and Irving Am. Mus. Nov., no. 1506, 7, 1951.

Kermadec White-faced Storm Petrel

Pelagodroma marina albiclunis

Cheeseman, who visited the Kermadecs in 1887, recorded the "Storm Petrel" as common at sea all round the Kermadec Islands and stated that Mr. T. Bell, who resided on Raoul Island, informed him that it bred on Meyer Island and other outlying rocks. This no doubt is correct, though during ten months' residence on Raoul Island in 1908 only two beach drift specimens were found, one by Iredale on Low Flat Beach and one by myself in Boat Cove, both being picked up in September. Several specimens were collected off Raoul and Meyer Islands by the Whitney South Sea Expedition in November, 1925.

Adult. The Kermadec subspecies differs from all other subspecies of *P. marina* in having the rump and upper tail coverts white instead of grey. The grey of the mantle does not extend on to the sides of the upper breast so as to form an incomplete collar as it does in *P. m. maoriana*. Undertail coverts white. Tail shorter and more square than in *maoriana,* the graduation being given by Murphy and Irving as less than 4 mm. in *albiclunis* and 10 mm. or more in *maoriana*. Bill black. Iris brown. Feet black, webs yellowish. Measurements recorded by Murphy and Irving: Bill 15-18, wing 144-166, tail 66-76, tarsus 37-43, mid toe 35-39 mm. Females average larger than males.

Distribution.—Kermadec Islands (Raoul Id., Herald Islets).

References.—Murphy and Irving, Am. Mus. Nov., no. 1506, 15, 1951. (*Pelagodroma marina albiclunis*, Kermadec Islands).

GENUS FREGETTA

Nasal tube generally free at the end and upturned. Tail square or doubly emarginate or slightly emarginate. Tarsi reticulate, or booted with traces of reticulations at each end. Basal joint of middle toe flattened, nearly equal to or longer than remaining joints and claw.

This genus includes three or four species which constitute a group of related forms of which the upturned nasal tubes and long flattened basal phalanx of the middle toe are the best distinguishing characters. The species range over the Southern Ocean.

Key to New Zealand Species

Mid toe longer than others, claws
pointed. Subg. Fregodroma .... *tropica*
Toes subequal, claws blunt.
Subg. Fregetta .... *grallaria*

References.—Bonaparte, Compt. Rend., 41, 1113, 1855 (*Fregetta,* type *Procellaria grallaria,* Vieill.) Ridgway, Auk., 3, 334, 1886 (*Pealea,* type *Thalassidroma lineata,* Peale). Mathews, Bull. B.O.C., 57, 145, 1937 (*Fregodroma,* type *Thalassidroma tropica*).

Black-bellied Storm Petrel

Fregetta tropica

This species of Storm Petrel is rarely observed on the New Zealand coast. The first definite record is that of Hutton who obtained a specimen at the Great Barrier Island in 1868. Some years afterwards a specimen flew against the lighthouse lantern at Mokohinau. More recently it was observed in large numbers by Rollo Beck and myself to the south of New Zealand. It was discovered breeding at the Auckland Islands by E. F. Stead in 1929.

Adult. Tail faintly rounded. General colour sooty black, darkest on the head and wings. Upper tail coverts, sides of body and greater under wing coverts white. A continuous band of black down the centre of the abdomen. Chin mottled with white. Bill and feet black. Iris brown. Bill 14-15, wing 160-170, tail 70-77, tarsus 38-42, mid toe 28-29 mm. Antipodes Island.

Eggs. Elliptic, blunt at both ends; white, with a broad ring of black dots at the larger end, 37 x 27, 38.5 x 27 mm. Auckland Islands.

Status. This species differs from its allies by the white of the under surface being only on the sides. This white shows when the bird is flying and thus enables it to be distinguished from Wilson's Storm Petrel. Murphy treats the type specimen of *Pealea lineata* as a colour phase of this species. It was collected in Samoa.

Distribution. Commonly seen off the Subantarctic Islands to the south of New Zealand, rarely observed on the New Zealand coast. It breeds at the Auckland, Antipodes and Bounty Islands. Other localities where observed: Mokohinau, Great Barrier Island,

C. J. Lindsay

BLACK-BELLIED STORM PETREL

Chatham, Campbell and Macquarie Islands. The Southern Ocean extending in the Atlantic and Indian Oceans north of the equator. Breeds at South Shetlands, South Orkneys, Falkland Islands, South Georgia, Crozet Islands, Kerguelen.

Habits. The following information relating to the breeding habits of this species at the Auckland Islands was supplied by Mr. E. F. Stead. "In a bare earth face, I found two tiny burrows about eighteen inches long, in each of which was a Black-bellied Storm Petrel sitting on an egg, one of which was quite fresh and the other slightly incubated. The nest, which was in a small chamber at the end of the burrow, consisted of a good handful of fine dry grass. The birds proved to be male and female. I found several other similar burrows, apparently just finished, so that it would seem that their nesting season was just beginning (February 1st)."

References.—Gould, Ann. Mag. Nat. Hist., 13, 366, 1844 (*Thalassidroma tropica,* Atlantic Ocean). Mathews Aust. Av. Rec., 2, 8, 1914 (*F. t. australis,* New Zealand). Godman, Monogr. Petrels, 59, col. pl. 1907. Buller, Birds N.Z., 319, 1873; 2nd ed., 2, 249, 1888. Kinghorn and Cayley, Emu, 22, 89, 1922.

White-bellied Storm Petrel

Fregetta grallaria

The admission of this species to the New Zealand avifauna is based on a single specimen taken in the New Zealand seas.

Adult. Above including the head and upper breast sooty black, the bases of the throat feathers white; lower breast and abdomen white, flecked with grey on the flanks; under tail coverts white. This is the white phase from Lord Howe Island. There is also, in the same locality, a dark phase in which the entire plumage is sooty black, with the bases of the feathers of the abdomen and upper tail coverts white. Birds in intermediate stages of colour occur. Average measurements: bill 13.5, wing 166, tail 78, tarsus 36.3, mid toe 22 mm.

Distribution. One specimen taken at sea. Whether or not this bird belongs to the Lord Howe Island breeding form has not been determined. Breeding on Lord Howe Island, Rapa, Juan Fernandez, Tristan de Cunha.

Habits. The nesting burrow on Lord Howe Island is described by Hindwood as being about 18 inches in length with an enlarged nesting chamber at the end about five inches in diameter, lined with a little dead grass. Eggs have been taken in January and February and an immature bird with some down adhering to its head on May 9th.

References.—Vieillot, Nouv. Dict. Hist. Nat., 25, 418, 1817 (*Procellaria grallaria,* West Coast, South America). Mathews, Bull. Br. Orn. Club, 52, 146, *Fregetta leucogaster deceptis,* New Zealand). Mathews, Nov. Zool., 39, 195, 1934 (*Fregettornis royana,* Lord Howe Island).

FAMILY PROCELLARIIDAE
FULMARS SHEARWATERS PRIONS

Bill straight with the tip strongly decurved, nasal tubes united on the culminal ridge with the openings directed forwards and separated by a septum. A hind toe present.

A large number of species distributed over the whole world but most numerous in the southern hemisphere.

Key to Subfamilies and New Zealand Genera

- Lower mandible not hooked at end; nasal tubes long (Fulmarinae).
  - Nasal tube small, narrow, lower at base .... *Daption*
  - Nasal tube long, wide .... *Fulmarus*
  - Nasal tube very long, stout .... *Macronectes*
- Lower mandible hooked at end; nasal tubes short.
  - Upper mandible lamellate within (Prachyptilinae).
    - Lamellae rudimentary, tail white at tip .... *Halobaena*
    - Lamellae well developed, tail black at tip .... *Pachyptila*
  - Upper mandible without lamellae (Procellarinae).
    - Nasal septum wide.
      - Nasal tube depressed, bevelled, unguis mostly small .... *Puffinus*
      - Nasal tube raised, truncate, unguis large .... *Procellaria*
    - Nasal septum narrow .... *Pterodroma*

GENUS DAPTION

Bill moderately slender, nasal tubes rather short, less than width of latericorn, lower at base, rami of mandible weak. Interramal space bare. Tail of 14 feathers.

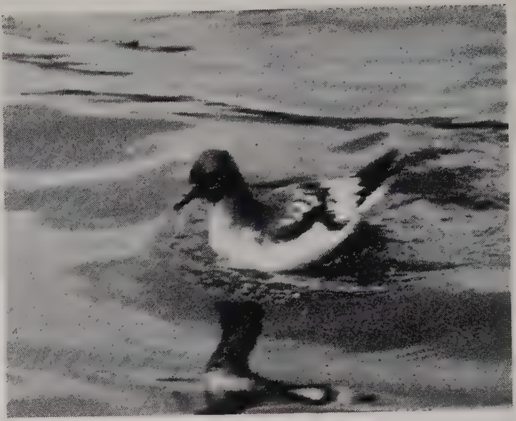
Daption is to be compared with Thalassoica and Fulmarus, but differs in the shorter nasal tubes and in the less deep mandibles. There is a single species ranging over the southern seas.

Reference.—Stephens, Shaw's Gen. Zool., 13 239, 1826 (*Daption,* type *Procellaria capensis,* L.)

Cape Pigeon

Daption capensis australis

The Cape Pigeon has long been known to voyagers in the southern hemisphere, being abundant in the cold and temperate seas and conspicuous on account of its black and white spotted plumage. It is the Pintado Petrel of Dampier's, Cook's and other early voyages to Australia. Sir Joseph Banks recorded the Pintado as having been observed in New Zealand waters during Cook's first voyage and then for nearly a century little more was heard of it as a New Zealand species until Gray listed it in 1862. It was shortly afterwards observed near the Great Barrier Island by Hutton and at the Chathams by Travers. In December, 1947, Mr. A. J. Black and Dr. R. A. Falla discovered a breeding colony of the Cape Pigeon on the Western Reef in the Snares group.



Half Moon Bay *L. E. Richdale*
CAPE PIGEON

Adult. Head, back and sides of neck, upper part of back, marginal wing coverts, and terminal portion of tail, sooty brown; primaries black with white on inner webs, and white on the outer web of the inner primaries increasing towards the innermost; secondaries, outer white, inner white with large sooty brown spot at the tips; base of tail white; remainder of upper surface white spotted with sooty brown, each feather having a terminal spot of that colour. Under surface white, except the chin, throat, and front margin of the wings which are sooty brown; in the winter the chin and throat are mottled with white. Bill black. Iris dark brown. Feet black, with fleshy patches on sides of toes. Bill 19-33, wing 250-280, tail 89-107, tarsus 34-47, mid toe 52-62 mm. *Nestling.* Covered with slaty grey down above, paler and more sooty below. South Orkney Islands. *Colour variety.* An all white Cape Pigeon was reported at Tory Channel by J. R. Eyles near the whaling station in the summer of 1949-1950.

Eggs. Clutch one, white, smooth, fine grained, without gloss, variable in shape. 67 x 40.5, 64.5 x 40, 62 x 44, 61.5 x 44.5, 60.5 x 42, 58.5 x 43.5 mm. Snares Island (Stead). The average of eggs from the Snares is 61.7 x 42.5 mm. which is smaller than the average given by Clarke of 62.35 x 43.1 mm. for eggs from South Orkneys.

Status. New Zealand and Australian birds are darker than those from the South Atlantic and have more spotting on the chin and throat. According to the New Zealand *Checklist* the typical subspecies, *D. c. capensis,* also occurs in New Zealand.

Distribution. The Cape Pigeon breeds on the Western Reef of the Snares Islands, and, probably, too, on the main island. It had long before been reported that sealers had landed on the Western Reef and taken and eaten the eggs of the Cape Pigeon. It breeds in large numbers on Leeward Island in the Antipodes group and on the Bounty Islands, where large numbers of Cape Pigeons are to be seen in the breeding season. Elsewhere in the New Zealand region it is frequently met with along the coast and at sea, being most common in the south. Localities where it has been observed include the Kermadecs, North Cape, Great Barrier Island, Kapiti, Stewart Island and the Chatham, Auckland and Campbell Islands.

The species is found in the Southern Oceans from the Antarctic Continent to the Tropic of Capricorn but straying northwards in the Atlantic to Brazil, Angola, the United States and Europe, in the Indian Ocean to Mozambique and Ceylon, and in the Pacific to the Marquesas Islands, Peru and Mexico. Breeds on the Antarctic Continent, the South Shetlands, South Orkneys, South Georgia, Kerguelen, Crozets and Heard Islands.

Habitat. The Cape Pigeon, except during the breeding season, spends its life at sea especially in the Antarctic and cold temperate seas. Abundant and conspicuous, it has been observed throughout the southern ocean by all travellers to those regions. It sails close to the surface of the water now and then giving its wings a few flaps. On the wing it can be instantly recognised by the brown and white colour above with a large conspicuous white patch on each wing and another on the rump. From underneath the wing spots are visible and the body is white.

Food. At the whaling stations at the Falkland Islands the Cape Pigeon collects in myriads to feed on the flesh and fat that form the refuse of such places. As a consequence it has greatly increased in numbers. The abundant food supply has evidently saved the life of nestlings that would otherwise have perished from the cold. At sea its principal food is small crustaceans and cephalopods.

Nesting. Although the Cape Pigeon has long been suspected of breeding in the Snares group actual proof dates from December, 1947, when the Snares Expedition in the *Alert* commanded by A. J. Black, visited the islands. Falla's account of this important discovery, published by Stead, is as follows:

December 4, 1947.—Cape Pigeon: During a circumnavigation of the main island in the afternoon, Cape Pigeons were again seen fussing round the steep headland on the south-west point, and also in fair numbers round the cliffs and stacks at the north end.

Alert was then headed out for the Western Reef where, owing to the unusual spell of easterly weather, it was found possible to land on one of the inner islets of the chain. It rose by a series of easy terraces of bare granite to an abrupt termination in high cliffs, and seemed at first devoid of all life except for seals on the lower edges and a pair of skuas.

However, before the summit was reached, a Cape Pigeon was found sitting on an egg beside a sheltering rock ledge. This was an outpost of more numerous nests near the summit. Many were deep in crevices, some on narrow ledges, and others on flat ground within a foot or two of some breakwind shelter. In the small area of fifty square yards or so adjoining the cliff edge that Mr. A. J. Black and I had time to examine, there were more than 50 nests. All were composed of heaps of sharp angular fragments of the much weathered upper rocks and had exactly the appearance of those I had seen on the Antarctic mainland. Most of the birds had eggs but a few were sitting on empty nests. There was a good deal of the "visiting" which is so characteristic of fulmars and enough cooing, clucking and cackling to remind one of a poultry yard. Their habits at the nest are similar to those recorded for the fulmar family everywhere, with defensive wing drooping and oil ejecting. Birds on the move shuffle to and from the cliff edge and most of the taking off and alighting is done there. A great deal of circling and cliff skimming seems to take place before any landings are effected.

The activity here described was all observed between 3 and 4 p.m.

References.—Linne, Syst. Nat., 10th ed. 132, 1758 (*Procellaria capensis,* Cape of Good Hope). Buller, Birds N.Z., 299, 1873; 2nd ed. 2, 215,

1888. Godman, Monogr. Petrels, 276, col. pl. 1907. Murphy, Ocean. Birds S. Amer., 1, 601, 1936. Falla, B.A.N.Z.A.R.E., Ser. B, 2, 146. 1937. Stead, N.Z. Bird Notes, 3, 72, 1948. Mathews, Austr. Av. Rec., 1, 187, 1913 (*D.c. australis,* New Zealand).

GENUS FULMARUS

Bill long, broad and high, the nasal tubes long, broad, concave above, united into a single opening directed forwards. Tail of 14 feathers.

Fulmarus is very closely allied to Thalassoica but has a broader bill with broader nasal tubes, and there are 14 rectrices instead of 12. Compared with Daption it has a longer and wider nasal tube. Two species, one in the northern, the other in the southern hemisphere.

References.—Stephens, Shaw's Gen. Zool., 13, 233, 1826 (*Fulmarus,* type *Procellaria glacialis* L.) Hombron and Jacquinot, Compt Rend., 18, 357, 1844 (*Priocella,* type *Fulmarus antarcticus* (not Gmel.) = *Procellaria glacialoides* Smith).

Silver-grey Petrel
Fulmarus glacialoides

The Silver-grey Petrel was met with in 1769 off the East Cape during Cook's first voyage. It was, however, not recognised as a species distinct from the Common Fulmar of the Arctic until Stephens in 1826 described it from the Cape Seas. In the New Zealand region it has been recognised only as an occasional visitor. It has been obtained or observed on twelve occasions, the first being Cook's record and the second a specimen found by Sir Walter Buller near the mouth of the Turakina River prior to 1873.

Adult. Hind part of neck, upper surface and sides of breast silver grey; primaries blackish on their outer webs. Remainder of plumage white. Bill pinkish horn colour, the nasal tubes bluish, the tips of both mandible black. Iris dark brown. Feet pinkish grey, webs pale yellow. Bill 41-47, wing 330-350, tail 124-140, tarsus 49-54, mid toe 67-71 mm.

Eggs. Clutch one, ovoid, granular, dull white, measurements (by Falla) of 12 eggs: length 72-80, breadth 48.5-52.5 mm. Cape Hunter.

Distribution. Twelve occurrences. Kaipara, Muriwai (west coast of Auckland), East Cape, Turakina River mouth, Tory Channel, Nelson, Kaikoura, New Brighton. Otago, Moeraki, Stewart Island, islands to the south of New Zealand (three specimens). The southern oceans from the Antarctic Continent northwards, straggling to St. Helena, Australia, New Zealand, Peru and Oregon. Breeds in Antarctica. The summer range extends only a short distance north of pack ice. In winter the species is found well north of the ice.

Habits. Cephalopods and crustaceans have been recognised in the stomachs of the Silver Grey Petrel. Nests were found on the coast and offlying islands of the Antarctic continent by members of the Australasian Expedition. For a nest the birds merely hollow out a shallow depression in the gravelly detritus in rock crevices facing the sea. Eggs were found in November and December, young and eggs at the end of December.

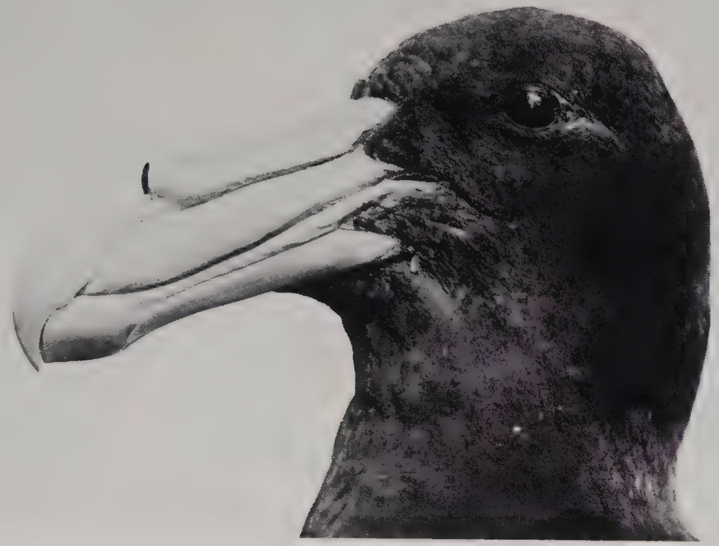
References.—Smith, Ill. Zool. S.Afr., pl. 51, 1840 (*Procellaria glacialoides,* Cape Seas). Buller, Birds N.Z., 301, 1873; 2nd ed., 2, 328, 1888. Godman, Monogr. Petrels, 165, col. pl. 1907. Falla, B.A.N.Z.A.R.E., Ser. B, 2, 158, 1937.

GENUS MACRONECTES

Bill long, stout; nasal tube long and broad, the base about as wide as the latericorn; aperture single, directed forwards. Interramal space feathered throughout. Tail of 16 feathers.

Macronectes is easily distinguishable from all other genera of petrels by the long nasal tubes which are three-fifths the length of the bill. Its nearest ally is Fulmarus. It comprises but a single species distributed over the southern oceans.

Reference.—Richmond, Proc. Biol. Soc., Wash., 18, 76, 1906 (*Macronectes,* type *Procellaria gigantea* Gmelin).



C. J. Lindsay

GIANT PETREL

Giant Petrel

Macronectes giganteus

Called by sailors the Nelly or Stinkpot, the Giant Petrel has long been known to voyagers to the southern seas. It was first described by Gmelin from specimens obtained in the Cape Seas. In the New Zealand area it was first observed during Cook's first voyage. It next appears to have been recorded by Dieffenbach in Cook Strait about 1840 and was subsequently observed at various points along the coast, as it flies close inshore and not uncommonly enters the harbours. Travers obtained it at the Chatham Islands in 1871 and Scott found it breeding on Macquarie Island in 1880.

Adult. Dark greyish brown, wings and tail darker. Light brown on face. Bill yellowish horn colour, pinkish in parts. Eyelids and skin folds at gape bluish grey. Iris bluish grey with dark flecks (Sorensen). Feet dark greyish brown. Length about three feet, span of wings up to seven feet. Bill 93-108, wing 500-565, tail 150-212, tarsus 84-104, mid toe 136-150 mm. New Zealand examples. *Immature.* Uniformly brownish black. Bill pale yellowish horn. Iris brown. Feet dark grey. When the immature plumage is moulting there is a rusty tinge on many of the feathers. *Nestling.* First down short, white. Second down long, dark grey, shorter and lighter on head, whitish band over eyes. Bill yellowish brown, dark brown at base. Iris dark brown. Feet lead grey.

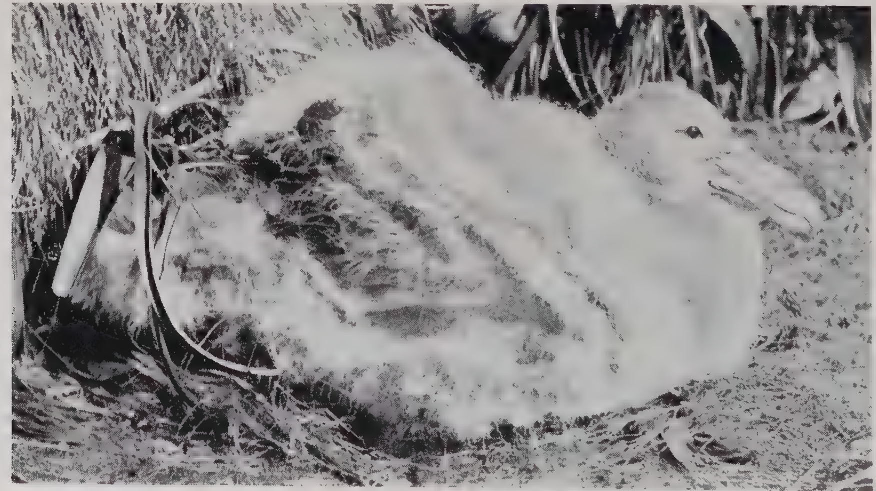
Colour varieties. In the more southerly part of its range this species shows greater variation than further north. In New Zealand the birds are mostly dark slaty brown, but in the Antarctic they are frequently white. At Macquarie Island, Ainsworth notes that the colour ranges through various shades from almost pure white to a dark greyish brown, some even appearing almost black. Jennings states that on Macquarie Island the young of the white Nellies are also white. Pure white examples are not common in New Zealand but have been obtained at Waikanae, Milford Sound and Macquarie Island and have been seen at

Portland Island, the Taranaki coast, Wellington harbour and the Chatham, Snares, Campbell and Bounty Islands. Much more frequent are white individuals with brown feathers scattered throughout the plumage. Such have been obtained in Foveaux Strait (one of these being the type specimen of Pott's *Ossifraga alba*), Kaikoura, and the Snares, Campbell and Macquarie Islands. Birds more intermediate in plumage, that is, those in which the white and brown are more or less evenly distributed, are common enough at Macquarie Island. The proportion of the white phase, pure and blotched, to normally coloured birds varies from one to two per cent. in New Zealand to ten per cent. at Macquarie Island and 12 to 18 per cent. in the Antarctic. According to Murphy white Nellies are white throughout their whole life history.

Eggs. Clutch one, white, surface rough and pitted. 101.5 x 64 mm. Chatham Islands. 101.6 x 67.6 mm. Adams Island. Auckland group. 95 x 57 mm. Macquarie Island.

Subspecies. Attempts have been made to divide *Macronectes giganteus* into subspecies (see first edition of this book, p. 106), but after examining specimens from many localities Murphy came to the conclusion that he was unable to recognise any subspecies. This position will be accepted here.

Distribution. Common along the coast of the North and South Islands, often entering harbours. It is more abundant in the south of New Zealand. It breeds on islands off Stewart and Chatham Islands and at the Auckland, Campbell, Antipodes and Macquarie Islands. Other localities where it has been observed are the Great and Little Barrier Islands, New Plymouth, Kapiti and the Snares and Bounty Islands. It is a regular visitor in the north of New Zealand; it can be seen in Wellington Harbour and in Cook Strait every month of the year; in Tory Channel as many as 200 have been seen at one time feeding on whale refuse. A bird ringed on Macquarie Island was taken at South Georgia, over 6000 miles distant. Another bird ringed in the South Orkneys was found on the beach near Dargaville, 6500 miles from where it was ringed, while a young bird ringed on Heard Island was taken seven weeks afterwards in the Chatham Islands. Another bird ringed in the same locality was taken at Moki Island, near Stewart Island, five months later. The Giant Petrel ranges over the southern oceans from the Antarctic Continent to the Tropic of Capricorn extending along the coast of



Campbell Island *J. H. Sorensen*

GIANT PETREL CHICK

Macquarie Island *A.N.A.R.E.*

GIANT PETREL

South America into the tropics and straggling as far north as California. Besides the New Zealand region it breeds on Falkland, South Georgia, South Orkney, South Shetland and Gough Islands in the South Atlantic Ocean; on the Crozet, Kerguelen, Prince Edward, Marion and Heard Islands in the South Indian Ocean; on the Antarctic continent at Adelie Land, Coats Land and Kaiser Wilhelm II Land.

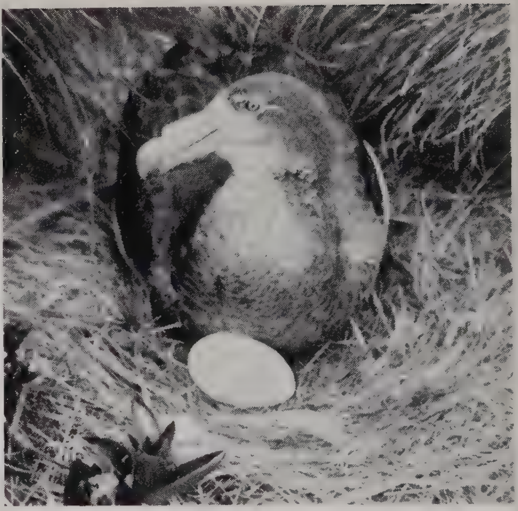
Habitat. The habitat of the Giant Petrel is the cold water region of the southern hemisphere from the Antarctic continent northwards to about latitude 30° S., though stragglers, especially on the west coast of South America, occasionally enter or even cross the tropics. In winter the general movement is northward, the birds then being found mostly at sea north of 65° S. lat. The Giant Petrel can often be seen off shore sailing close to the water every now and then flapping its wings several times in succession. Regularly it rises steeply in the air apparently to gain fresh impetus. Though very different at close quarters it could at sea be mistaken for the Sooty Albatross but its yellow bill and dark mantle would identify it. When alighting on the water the feet are thrust forward and the head held back. In rising the birds run along the surface flapping their wings vigorously.

Food. From the surface of the sea the Giant Petrel is known to take squids and crustaceans. Its main source of food, however, seems to be floating or stranded carcases, and includes besides whale and seal flesh, fish and sometimes small sea birds such as prions. Buller states that he actually observed a Giant Petrel capture a prion and then holding it by the wing batter it against the water until it was killed. It is reported also as killing the Little Blue Penguin.

J. H. Sorensen studied the Giant Petrel on Campbell Island and writes as follows regarding its breeding habits. "It is the gross feeding of the giant petrel which earns it the approbrium. It is not truly a bird of prey and rarely takes other birds as food. . . . Scavenging is the giant petrel's real occupation and nothing washed ashore or floating dead on the sea is overlooked, be it the carcase of a huge whale or the body of a tiny penguin. They are continually on the cruise for food and the carcase of a seal washed ashore will bring several dozens around in a very short time. Unless the remains are well decayed there is not much chance of all the birds being able to feed at one time. One 'bossy' bird will take up a position on the flank of the seal and make a small hole into the abdominal cavity. The whole head and neck are thrust in, and the kind of mess made is best left to the imagination! As the seal decays more and more birds get their chance, gorging themselves on this carrion until often they are unable to take wing again. They then sit around on the ground or fruitlessly try to wash the oil and filth off their soiled plumage in the water. If disturbed while in this gorged state they immediately vomit the stomach contents until they are light enough to take off."

Nesting. At Port Pegasus in Stewart Island the nests are large structures composed of sticks, dracophyllum leaves, grass and flax leaves. Scattered about the surface of Antipodes Island are many nests of the Giant Petrel and the wandering albatross. Both are crater-like structures made by the birds collecting the soil and leaves within reach. After the birds leave, a special association of plants including *Senecio antipoda* occupies the nests.

For the breeding of the Giant Petrel on Campbell Island Sorensen's account may again be quoted. "It is one of the earliest breeders on the Auckland and Campbell Islands, the single large white egg being laid at the end of August. The nesting birds definitely like a 'place with a view,' and nests are constructed on headlands or slopes near to steep cliffs facing into the prevailing wind. The nest is a fairly simple structure of loose tussock and grass gathered together by the incubating bird reaching out from a shallow depression on the selected site. Gradually a considerable mound is accumulated. It is usual for a number of birds to nest in one locality or colony, but occasionally one finds a single nest away from the others. Although the giant petrels are timid and unfriendly, incubating birds will remain on the nest unless suddenly startled. At one's approach the sitting bird utters a rasping note which terminates in a coughing squawk. This is the warning to keep away. Should one continue to approach the bird will almost invariably eject a quantity of evil-smelling oil with skill and precision. The chicks do exactly the same."



Campbell Island *L. J. Stanaway*

GIANT PETREL

On Campbell Island J. H. Sorensen reported eggs on August 15th and September 21st and chicks in down on November 3rd and on December 6th when the wing feathers were showing.

The Australasian Antarctic Expedition of 1911-13 found Giant Petrels on Macquarie Island throughout the year. There were several large breeding colonies, some being near the sea, others on high terraces. The largest, at Caroline Cove, was estimated by Blake to contain about 400 nests. These were about eight inches high and two feet across and were constructed of Pleurophyllum plants, tussock grass and moss. In each nest examined only a single egg was found. At South-west Harbour fresh eggs were found on September 8th and young on October 25th on which date there were still a few fresh eggs.

Maori. The Maori made use of the bones of the Giant Petrel, especially the leg and wing bones, for the manufacture of needles and awls. Some of these objects have been found in beds as old as the moa-hunter deposits in the Moa-bone Point cave at Sumner.

References.—Gmelin, Syst. Nat., 563, 1789 (*Procellaria gigantea,* Staten Island). Buller, Birds N.Z., 297, 1873; 2nd ed., 2, 225, 1888. Godman, Monogr. Petrels, 261, col. pl. 1907. Potts, Trans. N.Z. Inst., 6, 152, 1874 (*Ossifraga alba,* Foveaux Strait). Wilson, Nat. Ant. Exp. Aves., 93, 1907. Murphy, Ocean. Birds, S.Am., 1, 584, 1936. Falla, B.A.N.Z.A.R.E. Ser. B, 2, 137, 1937. Sorensen, Wild Life Subantarctic, 21, 1951.

Genus Halobaena

Bill with large hooked unguis, nasal tubes short, opening forwards as a single tube with a thin septum; latericorn scarcely expanded at the base. Lamellae on sides of palate rudimentary. Unguis of lower mandible hooked. Wings with first primary longest. Tail faintly wedge-shaped, 12 rectrices.

Halobaena is usually placed near the prions on account of its agreement in possessing lamellae on the sides of the palate, short nasal tubes, 12 rectrices and general colouration. The bill, however, recalls Pterodroma of the *cooki* group; so also does the mottling on the forehead. It differs from Pachyptila further, in the nearly square tail and in the lamellae being quite rudimentary.

There is a single species distributed over the Southern Ocean.

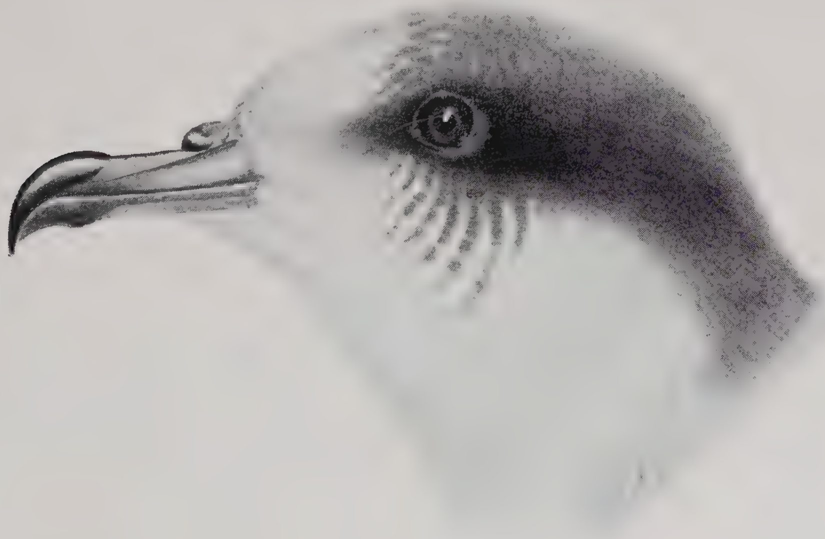
Reference.—Bonaparte, Compt. Rend., 42, 768, 1856 (*Halobaena,* type *Procellaria caerulea,* Gmel.)

Blue Petrel

Halobaena caerulea

The Blue Petrel was discovered in the Antarctic Ocean during Cook's second voyage. From Forster's drawing Latham described the "Blue Petrel" and Gmelin converted this to its scientific equivalent *caerulea.* The species was included in the avifauna of New Zealand by Buller in 1865 on the evidence of a specimen in the Auckland Museum. Twenty-one specimens have been obtained in the New Zealand area within the last eighty years.

Adult. Upper surface bluish grey; the secondaries and scapulars edged with white and the outer primaries dark brown on the outer webs; tail with a broad terminal band



R. J. Jacobs

BLUE PETREL

of white, the outer feathers mostly white; crown of head, nape and a patch round the eye slaty black; forehead mottled behind with brown and white. Front of forehead line over eye, throat, centre of breast and remainder of under surface white. Bill bluish black, with a stripe of bluish grey along the lower edge of the latericorn. Feet cobalt blue, the webs pinkish with red veins. Bill 25-27.5. wing 202-225, tail 82-97, tarsus 30-35.5, mid toe 39-44 mm. New Zealand examples. (Dell). *Nestling* covered with slate coloured down.

Eggs. Clutch one, more or less ovoid, white, smooth. 54 x 39.5, 52.5 x 36, 50 x 35 mm. Kerguelen. (Falla.)

Distribution. In the New Zealand region, known only as a straggler, the majority of the specimens having been found, according to Dell, from July to November. Dargaville, Little Barrier Island, Great Barrier Island, Muriwai to Karekare (8), Tamaki, Albany, Tauranga, Hunterville, Halcombe, Pakowai, Titahi Bay, Cape Campbell, Auckland Islands, Macquarie Island. Southern Ocean from Antarctica northwards to South latitude 40°, occasionally reaching as far as Tristan da Cunha, Cape Seas, Australia, Tasmania, New Zealand and Fiji. Breeding at Kerguelen and probably several other islands in the South Indian and South Atlantic Oceans.

Habitat. The Blue Petrel appears to be a truly oceanic bird, spending most of the year in the cold seas surrounding the Antarctic continent, only resorting to such inhospitable islands as Kerguelen to breed. Dr. Wilson states that 'in spite of a heavy sea, high wind, and occasional snow storms, numbers were seen flying round the ship and continued with it until the denser pack ice was reached."

Nesting. The breeding ground of the Blue Petrel on Kerguelen is thus described by Dr. Kidder. "The hillsides apparently quite deserted during the day, became at night perfectly alive with these birds. The burrows are excavated beneath the mounds of an umbelliferous plant (*Azorella selago*) which abounds on the Kerguelen hillside. The holes turn sharply to the right or left, parallel with the hillside, thence downward often doubling once or twice upon themselves and communicating with other entrances. At the bottom is an enlarged cavity lined with root fibres, twigs, ferns or leaves of the Kerguelen tea (*Acaena adscendens*), and quite dry. Here the single egg is to be found always covered with dry powdered earth or the leaves above mentioned. The first egg was found on the 23rd October, a young bird covered with slate-covered down was found on the 12th November and frequently thereafter."

References.—Gmelin, Syst. Nat., 560, 1789 (*Procellaria caerulea,* Southern Ocean). Buller, Birds N.Z., 306, 1873; 2nd ed., 2, 214, 1888. Godman, Monogr. Petrels, 281, col. pl. 1907. Falla, B.A.N.Z.A.R.E., B. 2, 188, 1937. Dell, Emu, 52, 147, 1952.

GENUS PACHYPTILA

Bill with latericorn broad at base, in some cases considerably swollen, lamellae on both sides of palate more or less developed, nasal tubes short, opening forwards. Wing with first primary longest. Tail wedge-shaped, rectrices twelve.

With most birds colour differences are used for specific definition while structural characters are used for generic diagnoses. In this group all the species are similarly coloured but there are considerable differences in the structure of the bills so that the relative value of colour and structure is reversed as compared with almost all other genera. From the Blue Petrel the species of Pachyptila are distinguished by the less deep bill, smaller nail, wedge-shaped tail, absence of a freckled pattern on the forehead, and the bar at the end of the tail being black.

The Prions have attracted the attention of many ornithologists and in particular New Zealand investigators, and different schemes of classification have resulted. Here I accept six species as defined by Falla in 1940. An interesting paper on the phylogeny and distribution of the Prions by C. A. Fleming appeared in the *Emu,* volume 41. The species are southern in distribution.

Key to Species of Pachyptila

- Bill short, stout, with straight outlines when viewed from above; lamellae represented by a weak ridge; nail large almost reaching the nasal tube (Pseudoprion).
  - Nail deep, wide and approaching close to nasal tube. Bill 22.5-24, breadth 10-12.5, depth 11.5 mm. .... *P. crassirostris*
  - Nail not deep, narrower and further from nasal tube. Bill 20-24, br. 9-12.5, depth 9-10 mm. .... *P. turtur*
- Bill slender to moderately wide, sides straight when viewed from above; lamellae developed but not visible in closed bill; nail weak with considerable space between it and nasal tube (Heteroprion).
  - Bill narrow, 25, br. 10-12 mm. *P. belcheri*
  - Bill larger and wider, 26.5-29, br. 12-15 mm. .... *P. desolata*
- Bill large and wide, the sides bowed outwards when viewed from above; lamellae well developed and showing at the base when the bill is closed; nail thick, not deep, with considerable space between it and nasal tube (Pachyptila).
  - Bill moderately wide, 28-33, br. 12.5-17 mm. .... *P. salvini*
  - Bill very wide, 33-37, br. 18-22 mm. .... *P. vittata*

References.—Illiger, Prodr. Mamm. Av., 274, 1811 (*Pachyptila,* type *Procellaria vittata,* Gmel.) Coues, Proc. Acad. Nat. Sci. Pa., 1866, 164 (*Pseudoprion,* type *Procellaria turtur,* Kuhl). Mathews, Birds Austr., 2, 222, 1912 (*Heteroprion,* type *H. Belcheri,* Math). Mathews, Emu, 37, 280 1938. Fleming, Emu, 41, 134, 1941. Falla, Emu 40, 218, 1940.

Bounty Island Prion

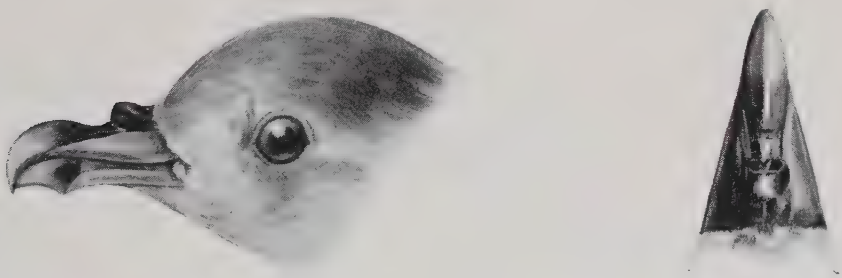
Pachyptila crassirostris crassirostris

The Bounty Island Prion was first collected by Reischek in 1888. In 1907 it was seen and photographed by G. Buddle and in 1927 Guthrie-Smith and I saw large numbers resting on the sea and sitting on rock ledges on the islands. This subspecies was found breeding at Antipodes Island in 1902.

Adult. Bill has the unguis thick, wide, blunt at apex and with the cutting edge not much curved at the tip. Upper surface blue-grey; the middle tail feathers with a broad blackish terminal bar. A black band covers the smaller wing coverts and passes over the lower region of the back and scapulars which are edged with white; primaries and their coverts black on the outer webs. A small spot in front of the eyes and a streak below them greyish black. Lores, superciliary streak and under surface white. Bill pale blue, darker on the culmen and base. Iris brown. Feet blue, the webs fleshy. Bill 22.5-24, width 10-11, wing 180-186, tail 88-100, tarsus 29-31, mid toe 38-42 mm.

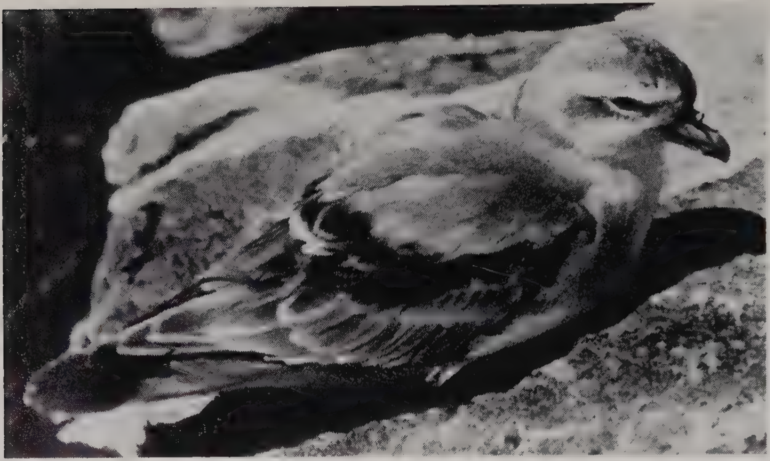
Eggs. Ovoid, white, 42 x 31.2, 44.4 x 34.8, 45 x 33.6, 47.2 x 32.8 mm.

Status. The distinguishing feature of



Lily A. Daff

BOUNTY ISLAND PRION



Bounty Islands *G. A. Buddle*

BOUNTY ISLAND PRION

Pachyptila crassirostris is the bill which agrees with that of *P. turtur* in profile but is wider and deeper in proportion to the length. The nail is more massive and comes nearer to the nasal tube. The differences between the subspecies are slight. *P. c. crassirostris* is smaller than *P. c. pyramidalis* from the Chatham Islands and the bill is narrower and less bulbous. The Antipodes Island birds included here are referred by Falla to the Heard Island form *P. c. eatoni.*

Distribution. Auckland, Antipodes and Bounty Islands, breeding. Straggler to Lyall Bay.

Habits. A specimen taken on the Bounty Islands was found to have its stomach full of small crustacea. It being impossible to make burrows in the granite rock of which the Bounty Islands are composed, the prions breed in crevices exposed to daylight. Their habits are different from those of the other prions as the birds are to be seen flying about and sitting in their nesting crevices in the daytime. They are very friendly and allow themselves to be handled.

References.—Mathews, Birds, Austr. 2, 221, 1912 (*Pseudoprion turtur crassirostris,* Bounty Islands). Mathews and Hallstrom, Notes Order Proc., 26, 1943 (*Fulmariprion crassirostris antipodes,* Antipodes Id.).

Pyramid Rock Prion

Pachyptila crassirostris pyramidalis

This distinct subspecies of the thick-billed prions was discovered by C. A. Fleming and E. G. Turbott on their visit to the Chatham Islands in December, 1937. It is carefully to be distinguished from the Fairy Prion (*P. turtur*) which breeds on other islands of the Chatham group.

Adult. Differs from *P. c. crassirostris* of the Bounty Islands in its larger size especially in length of wing and width of bill. Measurements (by Fleming) of male (type) and female from Pyramid Rock: bill 24, 24; width 12, 12.5; depth 9, 9; wing 203, 192; tail 102, 101; tarsus 32, 31; mid toe 42, 40 mm.

Distribution. Pyramid Rock and Forty Fours Islets, Chathams Islands. Breeding.

Habits. In his account of the birds of the Chatham Islands Fleming states that a search on December 16th resulted in the finding of two nests in which adult birds were incubating. "The nests were in holes beneath the nests of the Mollymawk (*Thalassarche cauta eremita*) and were so shallow that the sitting bird was plainly visible from without. There was very little nesting material."

References.—Fleming, Emu, 38, 400, 1939 (*Pachyptila eatoni pyramidalis,* Pyramid Rock).

Northern Fairy Prion

Pachyptila turtur armiger

Assuming that all the Fairy Prions breeding in the North Auckland area belong to one subspecies then the early records of *P. t. armiger* are Great Barrier Island 1868 (Hutton), Chicken Islands 1882 and Little Barrier Island 1887 (Reischek). In December 1924 I found this subspecies breeding on the Poor Knights.

Adult. Differs from *P. t. turtur* in the shorter and broader head. This shows in the greater average width of the bill, the skull being shorter and broader, and by the greater width between the supraorbital depressions. Skull length *P. t. armiger* 54, width at lacrymals 16, width between supraorbital depressions 2.4, length of mandible 43 mm.; same measurements in *P. t. turtur*, 56.5, 15, 2, 44.5 mm. Bill 22.5-25.5, width 11-12.5, wing 171-190.5, tail 82-94.5, tarsus 29.5-34, mid toe 38.5-42 mm. Poor Knights Islands. (P. Bull.)

Eggs. Clutch one, elliptic, slightly smaller at one end, white, 44 x 32.5 mm. Poor Knights.

Distribution. Besides the birds breeding on the Poor Knights those breeding on the Hen and Chickens, Little Barrier Island and Saddle Island (off Great Barrier Island) probably belong to this subspecies. Buddle records fairy prions in the Three Kings group in spring and summer.

Nesting. On the southern islet of the Poor Knights I found a nest under a fallen rock on a cliff-face ledge. The single egg (December 3rd, 1924) was heavily incubated. Burrows were found on the steep slopes facing west. In 1940, on the Poor Knights, G. Buddle found numerous nests among the crevices of rocks fallen from the cliffs. Only in isolated localities, he says, are earth burrows to be found. He continues: "By the last week of November all eggs had hatched and chicks in first down ranged from a few days to perhaps ten days old." This would bring the average date of laying, based on Richdale's estimate of eight weeks' incubation, for the southern Fairy Prion, to the beginning of October, that is to say, some weeks earlier than on Whero.

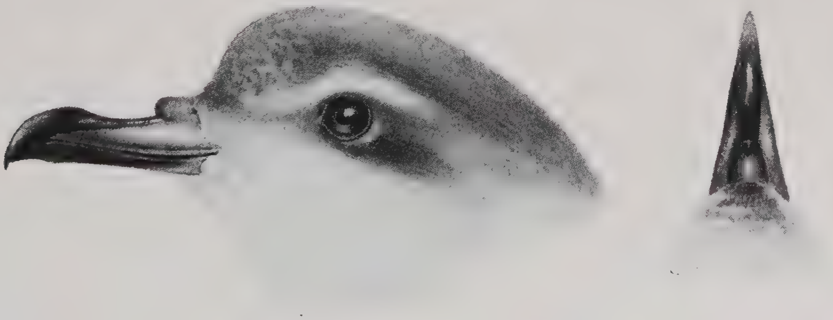
References.—Buddle, Emu, 41, 59, 1941. Mathews, Notes Procell., 23, 1943 (*P. t. armiger*, Poor Knights). Fleming, Emu, 44, 217, 1945.

Southern Fairy Prion. Titi Wainui

Pachyptila turtur turtur

The Fairy Prion was first discovered in Bass Strait whence specimens were described by Kuhl in 1820. In the New Zealand area it appears first to have been collected in Cook Strait by Dr. Lyall about 1850. Travers brought specimens from the Chatham Islands in 1871.

Adult. Bill with a relatively large unguis, bending sharply down at the tip, and a short space between it and the nasal tubes. Upper surface blue-grey; the middle tail feathers



R. J. Jacobs

SOUTHERN FAIRY PRION

with a broad blackish terminal bar. A black band covers the smaller wing coverts and passes across the lower region of the back and scapulars; primary coverts black; outer four primaries black on the outer webs, inner webs mostly white. A small spot in front of the eyes and a streak below them greyish black. Lores, superciliary streak and under surface white. Bill bluish grey, tinged violet, darker on the sides and base. Iris dark brown. Feet blue, tinged violet, the webs whitish. Bill 20-24, width 10-12, wing 175-190, tail 86-98, tarsus 29-32, mid toe 35-45 mm. *Nestling.* At first covered with long medium violet grey down which after a week is replaced by a second downy covering. Whero. (Richdale.) Covered with slaty grey down, whitish on the breast. Chatham Islands.

Eggs. Clutch one, elliptic or slightly ovoid, white, 44 x 31.5, 45 x 31 mm. Stephen Island. 44.5 x 32, 45 x 34, 44 x 31 mm. Chatham Islands. 45.5 x 33, 45 x 33 mm. Brothers.

Status. P. turtur comes nearest to *P. crassirostris* in the bill characters, the difference being the narrower and less deep bill of *turtur* with the unguis thinner and with a wider space between it and the nasal tube.

Generally speaking birds from almost all localities in New Zealand fall round about the measurements given above and therefore it is difficult to define subspecies. Possibly each breeding area will show characteristics of its own in size, colour, bill structure and feeding time, but names have been, perhaps too hastily, applied to some of these. The Chatham Island birds (*P. t. huttoni*), have rather stout bills. Birds breeding on Motunau Island (*P. t. oliveri*) have short bills averaging 22 x 11 mm. Breeding birds from Jackie Lees Island off Stewart Island are noticeably small, the bill averaging 21.8 by 9.9 mm. These measurements, however, are of small numbers and other collections from the same localities may give different results. From Whero, not far from Jackie Lees Island, Richdale measured 100 live birds and obtained bill measurements ranging from 20 to 24 mm. in length and 10 to 12 mm. in width.

Distribution. This is the most abundant of the prions inhabiting the New Zealand area. Specimens can be found washed up on almost every part of the coast. This subspecies has been recorded from Kapiti Island to Stewart Island and at the Chatham Islands. It is known to breed on Kapiti, Stephen Island, Trio Islands, the Brothers, Motunau, Banks Peninsula, Open Bay Islands, the islets off Stewart Island and the Chatham Islands. There is a specimen from the Snares (bill 23.5 x 11 mm.) in the Otago Museum. Australian seas, breeding in Bass Strait. Straggles north to New Guinea and east to the Falklands. Birds breeding in localities north of Kapiti Island and East Cape I have assigned to the northern subspecies *P. t. armiger.*

Habitat. Like *P. vittata* the Fairy Prion breeds within the subtropical temperature belt of ocean waters and along its convergence with the subantarctic belt. It is constantly to be seen in the offshore waters of New Zealand and further at sea flying just above the surface of the sea. At a distance it is scarcely visible on account of its dove grey upper surface. It becomes conspicuous when in turning in its flight it exposes its under surface and at close quarters may be recognised by the W-shaped black mark visible across the outstretched wings.

Food. Richdale, on the island of Whero, reports that euphausids (crustacea) were regurgitated by this species.

Nesting. L. E. Richdale has made a detailed study of the Fairy Prion on Whero Islet, off Stewart Island. Here, at the end of August, a few birds were present but according to Guthrie-Smith's observations on Herekopare, the burrows do not become occupied until early October. The peak time of laying, according to Richdale, is November 2nd, of hatching chicks December 27th and of departure of chicks February 14th. Richdale finds that, with the exception of the Poor Knights, all records of breeding dates coincide with those for

Whero. The burrows on Whero were mostly deep, beyond arm's length, but in shallow soil they may be only a hand's depth. The nesting chamber at the end of the burrow is wider than the burrow and usually lined with leaves of the teteaweka (*Olearia angustifolia*), but failing these any other kind of vegetation is used. When the chick has emerged from the egg the shell is usually removed from the nest to the mouth of the burrow. Richdale thinks that the chicks' eyes are open at hatching. Feathers begin to develop at the beginning of the third week and by the seventh week the down has disappeared and the chick becomes fully fledged, leaving the nest when about 49 days old.

Mr. J. H. Mihell, onetime lightkeeper on the Brothers, informs me that the Fairy Prion there breeds in burrows under low-growing taupata and that the tuatara and petrel seem to be quite happy lodging together in the same burrow. He noted the earliest hatched chick on October 27th.

References.—Kuhl, Beitr. Zool. Anat. 143, 1820 (*Procellaria turtur,* Bass Strait). Buller, Birds N.Z., 309, 1873; 2nd ed., 2, pp. 209, 213, 1888 (*Prion turtur, P. ariel*). Godman, Monogr., Petrels, 297, col. pl. 1907. Mathews, Birds Austr., 2, 220, col. pl. 1912 (*P. t. huttoni*). Oliver, N.Z. Birds, 114, 1930 (*P. t. fallai,* Otago, young bird). Falla, Emu, 40, 229, 1940. Richdale, Trans. Roy. Soc. N.Z., 74, 32, 165, 1944.

Subantarctic Fairy Prion

Pachyptila turtur subantarctica n. subsp.

The earliest record of this subspecies having been taken at Antipodes Island, so far as I am aware, is a specimen collected on the 31st July, 1924, and now in the Canterbury Museum. The subspecies was again collected on the same island by the *Alert* expedition of November, 1950. The type is the Canterbury Museum specimen mentioned above.

Adult. This subspecies is identical in colour with *P. t. turtur* of New Zealand but it is decidedly smaller in the bill, average measurements being 21 mm. in length and 10 mm. in width. Also the height of the bill at the base of the nasal tubes is slightly greater than in *P. t. turtur,* 46 per cent. of the length as against 42-43 per cent. in *P. t. turtur.* It thus resembles *P. crassirostris* more than *P. t. turtur.* Bill 21, width 10, wing 174-176, tail 87-94, tarsus 29-30, mid toe 38 mm. Antipodes Island.

Distribution. Antipodes Island. Breeding.

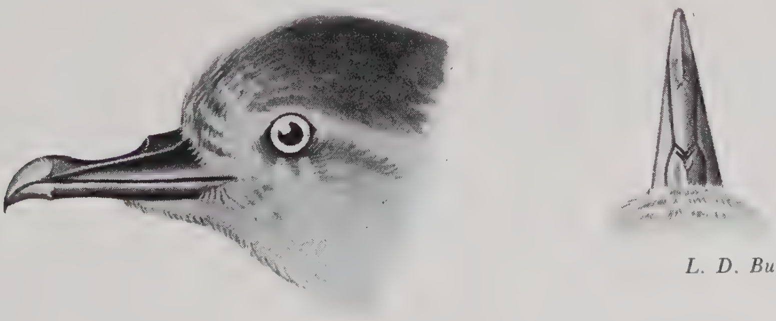
Thin-billed Prion

Pachyptila belcheri

"It is strange to consider," writes R. C. Murphy, "that the Slender-billed Whale-bird has been observed and doubtless collected, in waters off southern South America for well over a hundred and fifty years without being recognised as a distinct form."

This species was first described by Mathews in 1912 from a specimen taken at Geelong, Victoria. Later he recognised the same species from New Zealand, Western Australia and the Falkland Islands.

Adult. Bill narrow, the width less than a half of the length. Upper surface ashy blue, the long scapulars brownish black tipped with white, the marginal coverts, primary coverts and primaries brownish black; tail feathers



L. D. Buswell

THIN-BILLED PRION

except the two outer ones tipped with brownish black. Lores, superciliary streak and under surface white. Bill blue, the nasal tubes, culmen behind unguis, tip and basal plates of mandible deep violet blue. Iris brown. Feet blue, the web fleshy. Bill 24-28, width 9.5-11, wing 174-190, tail 80-96, tarsus 28-34, mid toe 38-42 mm. *Colour variety.* There is a pure white bird from Kaipara Harbour in the Auckland Museum, collected May, 1933.

Eggs. Clutch one, ovoid. white, dull, smooth, 50 x 36, 49.5 x 35.5, 46 x 34, 47.7 x 34.2 mm. Kerguelen (Falla).

Status. Distinguished by the long narrow bill with a profile like that of *P. desolata.*

Distribution. Winter visitor, probably visits New Zealand regularly but only observed when storm-killed birds are cast up on the beaches. These are mainly immature birds. Localities where specimens have been obtained: Raoul Island, Kaipara, Taranga Island, Muriwai, Onehunga, Karekare, Marton, Waikanae, Kapiti Island, Campbell Island. South Atlantic and South Indian Oceans, straying in winter as far east as New Zealand. Breeds on Kerguelen, Bouvet Islands and the Falklands, and probably on South Orkneys.

Habitat. The breeding range of the Thin-billed Prion lies on the southern border of the subantarctic ocean temperature belt and thus the species comes in contact with its relative *P. desolata* of the Antarctic zone.

Nesting. The breeding grounds of this species on Kerguelen have been described by Falla who visited the island in November, 1929, and February, 1930. Here the species nests in burrows in sheltered parts of Bras Bossiere inlet. Eggs judged to have been incubated ten days were found on November 19th and 20th. All the sitting birds were males. On the Falkland Islands, according to A. G. Bennett, the Thin-billed Prion occurs in countless numbers. Their burrows are so close together that a man walking over them sinks to the knees through past and present burrows. Vast numbers of the birds are eaten by skuas.

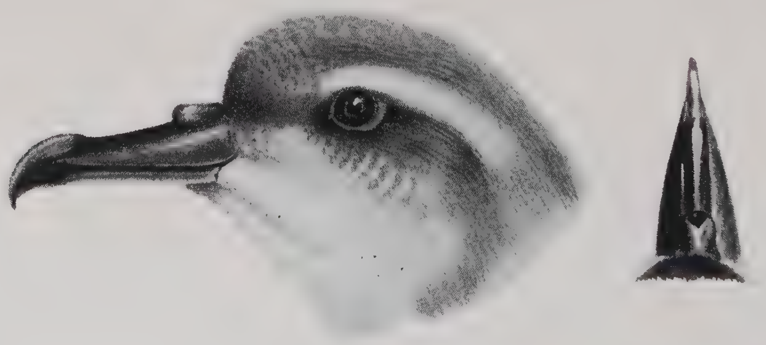
References.—Mathews, Birds Austr., 2, 274, 1912 (*Heteroprion belcheri,* Victoria). Falla, Rec. Auck. Mus., 1, 174, 1933; B.A.N.Z.A.R.E., Ser. B. vol. 2, 200, 1937.

Antarctic Prion. Dove Prion

Pachyptila desolata

The Antarctic Prion was taken at Kerguelen or Desolation Island in 1768 during Cook's first voyage, hence the specific name bestowed by Gmelin. It was taken on the Auckland Islands by Dr. M'Cormick of the British Antarctic Expedition in 1840 and found breeding there by Wilson of the National Antarctic Expedition in 1907. On Macquarie Island it was found breeding by J. H. Scott in 1880 and by A. Hamilton in 1894.

Adult. Bill moderately broad, width about



R. J. Jacobs

ANTARCTIC PRION

half the length, lamellae not visible when the bill is closed. Upper surface ashy blue, the long scapulars blackish tipped with white; marginal coverts, primary coverts and outer primaries blackish; central tail feathers with a broad terminal black bar. Feathers below the eye and ear coverts dark slaty grey. Lores, superciliary streak and under surface white. Bill, blue, the ridge of the culmen and nasal tube black. Iris dark brown. Feet blue, webs yellowish white. Bill 26.5-28.5, width 13.5-14.8, wing 175-190, tail 77-93, tarsus 29.5-32, mid toe 36-37 mm. Auckland Islands. Bill 27-29, width 13.5-15, wing 182-193, tail 82-97, tarsus 29-31, mid toe 33-41 mm. Macquarie Island. Bill 26.7-29.6, width 13.6-15.4, wing 182-194, tail 87.5-97.6, tarsus 31.6-34.3, mid toe 35.7-39.7 mm. South Georgia. (Murphy.) *Nestling* covered with neutral grey down, paler below. In the second downy stage there is greyish white on the breast and belly. Kerguelen. (Falla.)

Eggs. Clutch one, broadly oval, rounded at both ends, white, 45.5 x 34.6, 46.8 x 34.2, 44.5 x 32.5 mm. Auckland Islands. 48.5 x 34, 49.5 x 33 mm. Ocean Island, Auckland Islands, 51.5 x 36, 46.5 x 35.5 mm. Macquarie Island. 48.3 x 36.4 mm. South Georgia. (Murphy.)

Status. Pachyptila desolata is grouped with *P. belcheri* in the subgenus *Heteroprion* on account of the straight sided bill and the lamellae being covered when the mandible is closed. In size it is quite separated from *P. belcheri,* but it overlaps juvenile individuals of *P. salvini.* Measurements of specimens from all parts of its range give no clue to the subdivision of the species. Falla, who has studied the prions, admits difficulty in defining taxonomically the limits of subspecies and states that on Kerguelen there are two size groups. Other characters used by Falla are the tumescence of the bills and the fleshiness of the gular pouch but these are unlikely to be reliable characters as they are liable partly to disappear on drying. The only colour difference that I have observed is the darker crown in South Georgia birds (*P. d. banksi*) (only two specimens seen). This may give a character for defining two subspecies of *desolata* but no New Zealand specimens that I have examined show the dark crown of the South Georgian birds. Falla's classification of *P. desolata* is (breeding localities): *P. d. desolata,* Kerguelen, Macquarie Island, Antarctica; *P. d. alter,* Auckland Islands, Heard Island; *P. d. banksi,* South Georgia (straggler to New Brighton).

Distribution. Breeding on Auckland and Macquarie Islands. Specimens have been obtained at Whangarei Heads, South Kaipara Heads, Muriwai, Port Waikato, Pokeno, Napier, Castlecliff, Rangitikei, Waikanae, Titahi Bay, Palliser Bay, Lake Grassmere, Woodend, New Brighton, Chatham Islands, Campbell Island, Bounty Island.

South Atlantic Ocean, breeding on South Georgia and probably on South Orkneys. Tristan da Cunha. South Indian Ocean, breeding on Kerguelen and Heard Islands, and on the Antarctic continent at Cape Denison.

Habits. The Dove Prion is an Antarctic species. It is found in the cold seas surrounding the Antarctic continent and breeds on the islands on the northern boundary of the Antarctic temperature zone of the Southern Ocean and on the Antarctic continent. Scott who visited Macquarie Island in 1880 called this prion the "Night-bird" and said: "Makes its nest in burrows under the tussocks, where it can be heard during the day cooing like a dove. It leaves its nest at night and picks up its food at sea, a short distance from the land." A. Hamilton in 1894 also noted that it "flies to sea at nighttime, and is much persecuted by the *Ossifraga* and the *Lestris.*" (Giant Petrel and Skua.)

Nesting. At the Auckland Islands in certain localities the whole of the peat along the coast line is riddled by the burrows of the Dove Prion. They occupy the burrows both by day and by night long before the laying season. Stead found young birds, just getting their first feathers, in the burrows in early February.

In his report on the birds of the British, Australian and New Zealand Antarctic Research Expedition, 1929-1931, Falla has the following to say under Macquarie Island: "H. Hamilton noted that in 1911-13 the prions were seen round the coasts of the island in summer but not in winter. They were nesting in thousands on the higher slopes, foothills and flats, generally associated with *Pterodroma lessoni.* At the end of a winding burrow sometimes six feet in length was a roomy nesting chamber, with a nest of tussock built up often from a wet floor. Fresh eggs were plentiful at Lusitania Bay on 13th and 14th December, 1912. In December, 1930, we found the burrows on the lower slopes at the north end much damaged by woodhens, and here and there remains of adult prions that had been killed, perhaps by skuas."

On South Georgia Murphy found a colony of Antarctic Whale-birds surrounding several occupied nests of Wandering Albatrosses. Pagenstecher found the burrows under grass tussocks. The laying season extends from mid-November to the end of December. The young are hatched during January and February. The young, states Murphy, leave the burrows some time in May "usually long after the nesting grounds have been covered deeply by a blanket of snow."

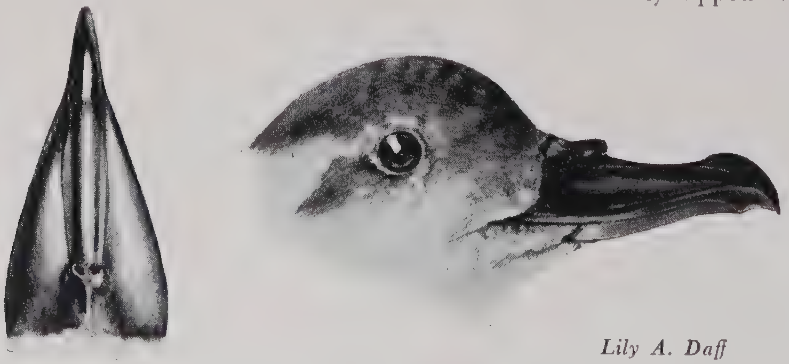
References.—Gmelin Syst. Nat. 562, 1789 (*Procellaria desolata,* Kerguelen). Godman, Monogr. Petrels, 293, col. pl. 1907. Mathews, Birds Austr., 2, 231, 1912 (*Heteroprion desolatus macquariensis,* Macquarie Island, *H. d. alter,* Auckland Is.) Murphy, Ocean. Birds. S. Am., 1, 620, 1936. Falla, B.A.N.Z.A.R.E., Ser. B, 2, 193, 1937; Emu, 40, 226, 1940.

Marion Island Prion

Pachyptila salvini

There is litttle doubt that birds belonging to this species have, under such names as *banksii, desolatus* and even *vittatus,* been sent to museums since the first book on New Zealand birds was published in 1871, in which Hutton erroneously gave the width of the bill of *vittata* as .6 inch (15 mm.). Probably the birds recorded by Buller as *Prion banksii* with bills measuring 34 x 15 mm. and of which he says: "After a storm on the coast in the month of July (1878) I found the Otaki beach strewn with the bodies of the Dove Petrel," belong to the species *salvini.* The name *salvini* was founded by Mathews in 1912 for Marion Island birds. It is a convenient label for small birds of the *vittata* type but it is not known where the birds which visit New Zealand in such large numbers breed.

Adult. Bill moderately broad, in New Zealand birds averaging 31 x 15.3 mm., lateral outline bowed when viewed above, lamellae showing to a small extent when the mandibles are closed. Forehead mottled white. Upper surface ashy blue, the long scapulars brownish black tipped with white; marginal coverts, primary coverts and primaries brownish black; tail feathers except the two outer ones broadly tipped with brownish



Lily A. Daff

MARION ISLAND PRION

black. Lores, superciliary streak and under surface white. Bill blue, the culmen black. Irides brown. Feet blue, webs whitish. Bill 28.5-33, width 14-16.5, wing 182-195, tail 83-94, tarsus 30-34, mid toe 36-43 mm. New Zealand specimens.

Status. Pachyptila salvini includes the smaller forms with characters similar to *vittata,* that is to say, bowed bill and visible lamellae. The dividing line as regards size is not very definite but is about 17 mm. in the width of the bill.

The typical subspecies, *P. s. salvini,* breeding on Marion Island, has the bill averaging 31.5 x 16.5 mm. The Crozets breeding subspecies, *P. s. crozeti,* has a smaller bill, averaging 29.3 by 15 mm. The New Zealand birds are intermediate, the average bill measurements being 30.9 by 15.3 mm. If, when a breeding locality in the New Zealand area is found, a name is required, it would be *P. s. maui* given to a Kapiti Island specimen. In addition to these Falla mentions five juvenile specimens from the Kermadec Islands and northern New Zealand with bills averaging 28.6 by 13.2 mm. and thinks that they might be attached to *crozeti.* But juvenile birds have smaller bills than adults, so there may not really be two subspecies in New Zealand.

Distribution. Birds are yearly cast up on the coast, sometimes, especially after heavy storms, in large numbers. Because the status of the species was not recognised past records are doubtful but the following localities are for specimens recently identified: Muriwai, Tauranga, Rangitikei beach, Castlecliff, Waikanae, Paraparaumu. The juvenile birds mentioned above are from the Kermadec Islands, Kaipara, Muriwai and Te Henga.

South Indian Ocean, breeding on Marion Island (*P. s. salvini*) and the Crozets (*P. s. crozeti*). Ranging in the non-breeding season eastward to New Zealand.

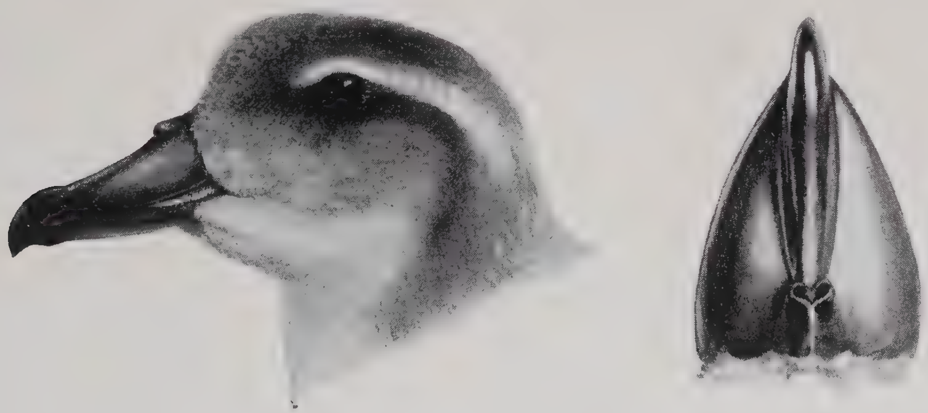
Habitat. The known breeding range of the Marion Island Prion, Marion Island and the Crozets, lies within the subantarctic temperature zone of the southern ocean. The beach specimens found in New Zealand are in localities in the subtropical temperature zone which is where they would be expected to be in winter. The remarkable feature is that they wander so far away from their breeding grounds in the non-breeding season.

References.—Mathews, Birds Austr., 2, 212, 1912 (*P. gouldi salvini,* Marion Island; *P. g. crozeti* Crozets). Falla, Emu, 40, 222, 1940. Buller, Birds N.Z., 311, 1873; 2nd ed., 2, 211, 1888 (*P. banksi*).

Broad-billed Prion. Parara

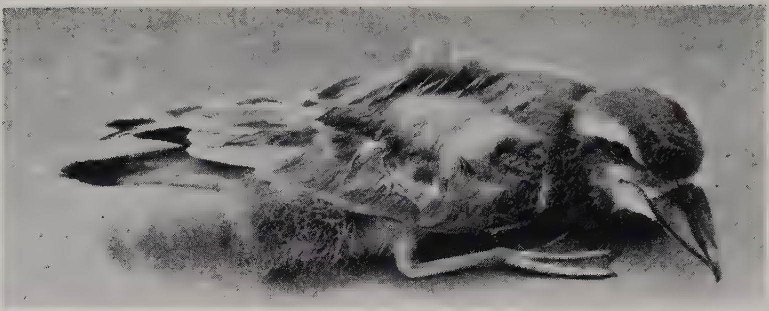
Pachyptila vittata vittata

The Broad-billed Prion was observed off the East Cape in 1769 during Cook's first voyage and again at Dusky Sound in 1773 by Forster, during Cook's second voyage. Like



R. J. Jacobs *Lily A. Daff*

BROAD-BILLED PRION



Whero Island *L. E. Richdale*

BROAD-BILLED PRION

many other of the birds obtained by Forster, it formed the subject of one of his drawings. It was described by Latham as the "Broad-billed Petrel" and was given its first scientific name by Gmelin. There is a specimen in the British Museum collected in New Zealand in 1846. In 1871 H. H. Travers found the species breeding at Pitt Island in the Chatham group.

Adult. Bill very broad at base, the sides convex, large lamellae on the sides of the palate, visible when the bill is closed. Width two-thirds of length. Upper surface blue-grey; crown darker and mottled with black; the long scapulars blackish tipped with white, the marginal coverts, primary coverts, and outer primaries blackish; central tail feathers with a terminal black bar; a patch of blackish on the rump. A patch below and behind the eye blackish. Lores, superciliary streak and under surface white. Bill: nasal tubes, culmen and dertrum black, latericorn purplish blue, glistening; lower mandible light purplish blue, dertrum and sulcus black. Feet purplish blue, darker on the joints of the toes; webs yellowish, finely lined with brown. Waikanae. Bill 31-37, width 17-22, wing 200-220, tail 95-106, tarsus 32-36, mid toe 40-44 mm. *Nestling* covered with smoky grey down, lighter on the under surface. Lamellae of upper mandible not developed.

Eggs. Clutch one, elongate elliptical, sometimes one end wider, white, 47.7 x. 35.6, 51 x 36, 45.8 x 33, 49 x 37 mm. Chatham Islands. Measurements (by L. E. Richdale) of 12 eggs from island off Stewart Island: length 45.3-52.5, breadth 36-37.8 mm. Egg from Tristan da Cunha, 50 x 33 mm.

Status. The Broad-billed Prion is easily recognised by its very broad bill with curved sides, and by the fact that the lamellae on the upper mandible are exposed when the bill is closed. Its next nearest relative, *P. salvini,* has a much narrower bill though the sides are bowed and the lamellae show when the bill is closed, but in much lesser number than in *P. vittata.*

The typical subspecies, *P. v. vittata,* has a broad bill, 33-37 mm. long and 20.5-22 mm. broad. Smaller birds with bill measurements 31 by 17-18 mm. have been obtained at St. Paul Island and on the Australian coast. They may be subspecifically distinct and if so should be called *P. v. macgillivrayi.*

Distribution. Found commonly all round the coasts of the North and South Islands. Breeds at Dusky Sound, islands off Stewart Island and in Foveaux Strait, the Snares and the Chatham Islands. Other localities where specimens have been obtained or the species observed include Little Barrier Island and Kapiti. Storm-driven specimens are sometimes found inland, for example, Pahiatua and Lake Wanaka.

The southern oceans, breeding on Tristan da Cunha and Gough Islands in the South Atlantic. Non-breeding birds have been taken at the Falkland, Marion and Crozet Islands.

Habitat. The Broad-billed Prion breeds on islands that lie near the borderline between the subantarctic and subtropical zones of ocean water temperature. In the non-breeding season it ranges through the subantarctic zone and northward through the subtropical zone into the tropics, birds having been reported off Madagascar and Reunion.

Food. The food of the parara, as recorded by Richdale, for birds nesting on the islands off Stewart Island, consists of crustaceans, mainly copepods, stalked barnacles, pteropods and small fishes.

Nesting. H. H. Travers visited the Chatham Islands during the latter half of 1871 and has placed on record a brief account of the breeding habits of the parara. He says that the blue billy of the settlers breeds in cavities of cliffs on the sea shore, or in holes burrowed in the soft peaty soil which covers the tops of most of the small islets. The hole dips slightly, is from 18 to 24 inches deep and quite straight. It breeds in September and only one egg is laid. Where the egg is laid in holes in rocks it is placed on the bare rock, but in the peaty holes a few leaves are found. Both birds take part in incubation. They are not easily disturbed when sitting, pecking at the hand whilst the egg is taken, but remaining on the nest after its removal.

This first account of the breeding of the parara is of considerable interest. Sixty-six years afterwards Fleming and Turbott visited South-east Island during the latter half of December. They found young in the fledgling stage with some down still remaining. A few adult birds were coming ashore by night. The nests were lined with grass and leaves. Skuas killed large numbers of parara and skeletons were found on nests of the Black-backed Gull.

On the islands off Stewart Island where the parara breeds Richdale was able to study the habits of this species from early December to March. The burrows are found mainly in the hard banks, under rocks and beneath clumps of Muehlenbeckia, and are up to four feet in length. The laying period was determined as from August 26th to September 16th, the peak being September 6th. Hatching occurs during the last week of October and the first half of November, the peak being November 1st. The average incubation period is 56 days. The chicks were observed to leave the island between December 8th and the first few days in January, the peak period being between the 10th and 20th. The adults are absent until early in February. After that they are present spasmodically until at least the end of April.

References.—Gmelin. Syst. Nat., 560, 1789 (*Procellaria vittata,* New Zealand). Potts, Ibis, 1873, p. 85 (*P. australis,* Foveaux Strait). Travers, Trans. N.Z. Inst., 5, 220, 1873. Buller, Birds N.Z., 312, 1873; 2nd ed., 2, 212, 1888. Godman Monogr. Petrels, 285, col. pl. 1907. Fleming. Emu, 38, 399, 1939. Falla, Emu, 40, 219, 1940. Richdale, Emu, 43, 191, 1944.

GENUS PUFFINUS

Bill long, slender, unguis not abruptly raised above the culmen. Nasal tubes bevelled in front, septum wide, both apertures visible from above. Tail wedge-shaped or rounded, rectrices 12. Tarsi compressed, anterior edge sharp.

The genus as thus defined comprises those petrels which have a slender bill with nasal openings separated by a wide septum and directed upwards. The larger species approach Procellaria, differing mainly in the more slender bill with more bevelled nasal tube. From Pterodroma the species of Puffinus may be distinguished by their slender bill, with wide septum to the nasal tube. Among the species differences are found in the nasal tubes which may be bevelled at a high or a low angle or may be raised or depressed, and in the tail which may be wedge-shaped or rounded.

Puffinus comprises about 17 species distributed over the seas of the whole world.

Key to New Zealand Species of Puffinus

Nasal tubes depressed, front bevelled at low angle, tail rounded.
  Slaty black above, white below.
    Axillaries white .... *P. assimilis*
    Axillaries brown .... *P. gavia*
  Sooty black.
    Under wing coverts brown *P. tenuirostris*
    Under wing coverts white .... *P. griseus*

Nasal tubes elevated, front bevelled at high angle.
  Tail wedge-shaped.
    Sooty black .... *P. pacificus*
    Grey above, white below .... *P. bulleri*
  Tail rounded.
    Under surface white .... *P. diomedea*
    Under surface blackish brown .... *P. carneipes*

References.—Cuvier, Regne. Anim., 1, 516, 1816 (*Puffinus*, type *Procellaria puffinus*, L.). Stejneger, Proc. U.S. Nat. Mus., 11, 93, 1888 (*Thyellodroma*, type *P. pacificus*). Iredale, Austr. Av. Rec., 2, 20, 1913 (*Hemipuffinus*, type *P. carneipes*).

Kermadec Allied Shearwater

Puffinus assimilis kermadecensis

The Kermadec Allied Shearwater was first collected by Macgillivray, who visited Raoul Island in H.M.S. *Herald* in 1854, on the outlying Herald Islets. It was afterwards well known to the Bell family, who resided on Raoul Island and who called it the Long-billed Titi. Specimens were obtained by Cheeseman in 1887 and by the Kermadec Islands expedition in 1908.

Adult. Upper surface slaty to slaty black. Under surface from the lores and face to the under tail coverts white. Bill black above, light blue below. Iris brown. Feet light blue, webs pale yellowish, outer margin of outer toe black. Bill 24-27, wing 180-195, tail 66-80, tarsus 34-41, mid toe 44-49 mm. *Nestling* covered with grey down, darker above, whitish on the abdomen.

Eggs. Clutch one, short- or long-ovoid, white, 51 x 37, 54 x 37.5, 56 x 34.5 mm.

Status. Similar in colour to *P. a. assimilis* but bill, wing and tarsus longer on an average. Hardly differs from *P. a. haurakiensis* either in colour or measurements.

Distribution. Kermadec Islands, breeding on Meyer Island in the Herald Group.

Voice. The call of this bird is most peculiar. It consists of a short guttural cry supposedly made by the outgoing breath, followed by a different sound made by the incoming breath. This is repeated two or three times.

Nesting. At the Kermadecs the Allied Shearwater breeds only on Meyer Island. Its peculiar cry was heard in April but early in May it arrived in large numbers and made burrows one to two feet long in the loose soil of the steep slopes of the island. The eggs are laid towards the end of June but mostly in July, and the young are hatched during August. Eggs were plentiful and three nestlings were seen on August 3rd.

References.—Murphy, Am. Mus. Nov., 276, 3, 1927 (*P. a. kermadecensis*, Herald Islets). Godman, Monogr. Petrels, 133, col. pl. 1907. Iredale, Emu, 10, 12, 1910.

New Zealand Allied Shearwater

Puffinus assimilis haurakiensis

This subspecies was probably the one which Hutton, in 1868, observed off Great Barrier Island. In 1880 Reischek discovered its breeding place on Morotiri, one of the Chicken Islands. It was defined as a subspecies distinct from the other kinds found in New Zealand by Fleming and Serventy in 1943.

Adult. Similar in colouration to *P. a. kermadecensis* but slightly larger and with a slightly wider bill. Bill bluish slate, the nasal tube, culmen and upper and lower nails black, gular area bluish mauve. Iris brown. Feet light blue, webs fleshy, sides of foot, edge of web, soles and claws black. Hen Island. (Fleming.) Bill 23-29, wing 180-200, tail 63-72, tarsus 40-43, mid toe 43-46 mm. The range of measurements is practically that of *P. a. kermadecensis*. *Nestling.* First down light grey with throat, breast and abdomen white. Morotiri Island. Second down dark grey with band of white from throat to abdomen.

Eggs. Ovoid, blunt-pointed, white, 52.8 x 38.3, 54 x 37.5, 56.5 x 37 mm. Mokohinau.

Status. This subspecies appears to me to be too close to *P. a. kermadecensis* and probably should be merged into it.

Distribution. Northern New Zealand as far south as Hauraki Gulf. Breeds at Three Kings (probably), Mokohinau, Hen and Chickens, Little Barrier Island and Cuvier Island. Elsewhere specimens have been obtained at Muriwai, Kapiti Island and Palliser Bay.

Food. Remains of cephalopods and minute crustacea have been found in the stomachs. (Falla.)

Nesting. Sandager records that on Mokohinau the Allied Shearwater is a winter breeder. His account is as follows: "Not very numerous, though it breeds on all the Mokohinau Islands. The burrow is generally under a rock, in the interstices between rocks, or less frequently on the level ground below a root or tussock. Burrowing commences in April and May, and is carried on at night only, so that the birds are rarely found in the burrows during the day, previous to laying. Nesting-material is deposited in the burrow during June and July, and at the end of the latter month laying commences, and extends to the middle of August." Since Sandager wrote eggs have been found at Mokohinau on July 10th.

Reischek investigated a breeding colony on Morotiri, one of the Chickens, in 1880, and found an entirely different breeding season. He said that the birds come ashore in October to clean out the burrows and make fresh ones. The burrows are four inches in diameter and from three to four feet in length. The nest consists of a few leaves and pieces of grass and the egg is laid in October or early in November. The young are fully fledged in February. The birds were breeding in company with the tuatara (*Sphenodon punctatum*).

References.—Fleming and Serventy, Emu, 43, 119, 1943 (*P. a. haurakiensis,* Mokohinau). Reischek, Trans. N.Z. Inst., 18, 95, 1886. Buller, Birds N.Z., 2nd ed., 2, 239, **1888.** Sandager, Trans. N.Z. Inst. 22, 290, 1890. Falla, Rec. Auck. Mus., 1, 253, 1934.

Norfolk Island Allied Shearwater

Puffinus assimilis assimilis

Gould described *Puffinus assimilis* in 1838 from specimens obtained at Norfolk Island. The only claim for this typical subspecies to be included in the New Zealand avifauna is based on three storm cast specimens found on Muriwai beach, the first being obtained by C. A. Fleming in June, 1939.

Adult. Colour similar to *P. a. kermadecensis,* but bill, wing and tarsus noticeably shorter. Bill 22-24, wing 178-186, tail 66-71, tarsus 35-37, mid toe 42-44 mm.

Status. As a species *Puffinus assimilis* includes the four subspecies found in New Zealand, *P. a. godmani* breeding on Madeira and *P. a. tunneyi* breeding in Western Australia.

The closest relative of the Allied Shearwater is the Dusky Shearwater (*P. lherminieri*) of the warmer seas of the world, from which it is distinguished by its slaty upper surface, mostly white under tail coverts and bluish feet, the Dusky Shearwater having the upper surface blackish brown, the under tail coverts largely or entirely dark and the feet flesh colour. The only New Zealand species with which the Allied Shearwater can be confused is the Fluttering Shearwater, but the smaller size slaty upper surface and white axillaries differentiate it.

Distribution. Muriwai. Three occurrences. North Tasman Sea from the coast of New South Wales to New Zealand, breeding on Lord Howe and Norfolk Islands.

References.—Gould, Syn. Birds Austr., pt. IV, App. p. 7, 1838 (*P. assimilis,* Norfolk Island). Fleming and Serventy, Emu, 43, 117, 1943; 52, 17, 1952.

Chatham Island Allied Shearwater

Puffinus assimilis elegans

During Cook's first voyage Allied Shearwaters were met with in the South Pacific and in the New Zealand area off Poverty Bay and the Three Kings. Solander in his manuscript describes a specimen taken at sea in S. Lat. 48° 27′, and W. Long. 93°. This has been identified with the present subspecies though the short Latin diagnosis might apply to any of the subspecies of *Puffinus assimilis.* Perhaps Forster's drawing, which I have not seen, justifies reference to the subspecies *elegans,* and to the form of *assimilis* breeding at the Chatham Islands. The first specimens of this bird collected at the Chatham Islands were taken by W. Hawkins in 1892.

Adult. Upper surface slate colour, the feathers of the back and sides of neck, back, wing coverts, secondaries and upper tail coverts margined with white. Primaries with inner two-thirds of inner vanes white. Pileum darker than back, feathers not edged with white, the dark colour extending below and behind the eye. Lores speckled. Sides of breast slaty. Under surface white. Bill 23-27.5, wing 170-196, tail 64-69, tarsus 39-41.5, mid toe 45-48 mm. Chatham Islands and east of Antipodes Island.

Distribution. Breeding at the Chatham Islands; also obtained at Hokitika, Solander Islands and near the Auckland and Antipodes Islands.

The subantarctic zone of the southern ocean, breeding at Tristan da Cunha and Gough Islands.

Nesting. On the evidence of an apparently immature bird found by Fleming at the Chatham Islands in January it was suggested by him that the breeding season of this subspecies is the winter time.

References.—Giglioli and Salvadori, Ibis, 1869. p. 68 (*Puffinus elegans,* S. Atlantic). Murphy, Ocean. Birds. S. Amer., 2, 682, 1936. Fleming and Serventy, Emu, 43, 122, 1943.

Fluttering Shearwater. Pakaha

Puffinus gavia gavia

The Fluttering Shearwater was first collected by J. R. Forster, one of the naturalists of Cook's second voyage, in 1773 in Queen Charlotte Sound, and the publication by Lichtenstein in 1844 of Forster's description was the first introduction of the bird to science, hence it is sometimes called Forster's Shearwater. New Zealand ornithologists were slow to recognise the species, but Hutton, in 1871, established the identity of specimens from Cook Strait with Forster's *Procellaria gavia.*

FLUTTERING SHEARWATER

Adult. Upper surface blackish brown, the quills and tail black. Sides of head and neck mottled ashy and white. Under surface white, the axillaries brown with white tips. Bill lead colour, culmen and unguis black, lower mandible purplish. Iris brown. Feet lead colour, the outer toe, sole and claws black. Bill 29.4-36, wing 180-221, tail 56-66, tarsus 37-46, mid toe 43-51 mm. *Nestling* covered with greyish brown down. Saddle Island.

Eggs. Clutch one, ovoid, white, 58.4 x 41.8, 61 x 40.5, 57.6 x 39.6 mm. Chetwode Island.

Status. In a recent revision of the small shearwaters related to the Fluttering Shearwater of New Zealand Murphy has united eight forms from the Pacific and Atlantic Oceans, most of them at one time or another regarded as species or subspecies of *Puffinus puffinus.* In no case do the breeding areas overlap. On the basis of their general colouration Murphy divides these subspecies into two groups, black backed and brown backed, and emphasises the close relationship of four (out of five) of the brown-backed subspecies, namely, *yelkouan* from the eastern Mediterraneon, *opisthomelas* from the North Pacific, and the two New Zealand subspecies. He compares *P. p. gavia* with *P. p. yelkouan* thus: "*Puffinus puffinus gavia* is a match for the race *yelkouan* except in the following minor respects: (1) smaller size (the average difference is not more than 10 per cent. in any dimension and less in most); (2) slightly darker (but still white-tipped) axillary feathers; (3) wider individual variability in the mottling at the sides of the neck; and (4) under tail coverts consistently white, instead of prevailingly or laterally greyish brown as in *yelkouan.*" While demonstration of the close relationship of these forms is an important addition to our knowledge the name changes proposed by Murphy have not been accepted in the *Checklist of New Zealand Birds.* I agree with this course.

Distribution. Very common in the Auckland province and about Cook Strait. Breeds on Three Kings, Poor Knights, Mokohinau, Hen and Chickens, Little Barrier Island, islets off Great Barrier Island and the east coast of North Auckland peninsula; islands in the Bay of Plenty, Mercury, Alderman, Whale and others; Stephen, Chetwode and other islands in Cook Strait. Ranges as far as the Chatham Islands and Banks Peninsula. Straggler at Circle Hill, Otago.

Coast of New South Wales, breeding. Recorded from New Caledonia and New Hebrides.

Habitat. The breeding places of *P. gavia gavia* are just within the southern boundary of the subtropical belt of ocean waters.

The Fluttering Shearwater appears to be a stationary species being found mainly in the seas adjacent to its breeding grounds. Thus it is common in the north of New Zealand and about Cook Strait. It is frequently met with in flocks off the coast and is noticeable by its flight which differs from that of most other petrels in consisting mainly of rapid flaps of its wings, hence its name Fluttering Shearwater.

Food. Mr. B. Sladden supplies me with the following note. "*P. carneipes, P. gavia* and *P. bulleri* work together when the plankton is close enough to the surface to be within reach. The plankton consists of a small crustacean and a fish of the pilchard type. *P. gavia* can go down to a considerable depth for its food."

Voice. According to Reischek the adult birds on Little Barrier Island make a sound resembling the cackling of a fowl, especially before bad or wet weather hence the European name Rainbird. On the wing their cry is said to resemble the Maori name "pakaha" somewhat prolonged.

Nesting. A typical breeding colony is that on Saddle Island in Hauraki Gulf, whose slopes are covered with taupata (*Coprosma repens*) scrub. The soil beneath this scrub is soft and entirely riddled with the burrows of these birds. The burrows are close to the surface, two to three feet long, and terminate in an enlarged space in which is a nest made of a few dead leaves and feathers. At the time of my visit, January 15th, the young were quite large with the wing and tail quills just appearing through the down.

Reischek, who lived on Little Barrier Island for some months, gives the following particulars concerning the breeding habits of the Fluttering Shearwater. It comes on shore in September to clean out the burrows and make fresh ones, which work takes place only in the daytime and is accomplished by digging with the bill and throwing out the soil with the feet. The eggs are laid in October. Incubation is carried out by both parents the female sitting during the day and the male at night. When the young are a few days old, both birds absent themselves during the day, returning in the evening to feed them by disgorging into their mouths an oily substance. The young leave the breeding ground during March.

For the birds breeding on islands off the coast of North Auckland Falla gives adults as coming ashore in September; fresh eggs as being found at the end of September and early in October; and the young as leaving the nests about the end of January.

Maori. In the Bay of Plenty, especially at Whale Island, the Fluttering Shearwater formerly formed one of the food supplies of the Maori, who took the young birds and potted them in their own fat. During the early part of the breeding season the island was strictly tapu, no one being allowed to land there. The tapu was of course lifted when the young birds were in good condition for eating.

References.—Forster, Desc. Anim., 148, 1844 (*Procellaria gavia,* Queen Charlotte Sound). Buller, Birds N.Z., 318, 1873; 2nd ed., 2, 336, 1888. Godman, Monogr. Petrels, 120, col. pl. 1907. Reischek Trans. N.Z. Inst., 18, 93, 1886. Falla. Rec. Auck. Mus., 1. 252, 1934. Serventy, Emu, 40, 403, 1941. Murphy, Am. Mus. Nov., no. 1586. 15, 1952.

Huttons Shearwater

Puffinus gavia huttoni

This subspecies was first collected at the Snares by Dannefaerd in January, 1890. Several specimens were collected off Banks Peninsula in 1926 by the Whitney South Sea Expedition of the American Museum; one was collected at Waikanae in 1927 and another at Kapiti in 1935.

Adult. Larger than *P. p. gavia,* with longer bill and wing; the brown on the sides of the upper breast encroaching towards the front further than on the throat; axillaries light brown. Measurements (by Murphy) of 17 specimens from off Banks Peninsula: bill 34.4-38.3, wing 215-229, tail 60.7-70.3, tarsus 40-43.9, mid toe 45.2-49.7 mm.

Distribution. Muriwai beach, Kapiti, Waikanae, Pukerua Bay, Seatoun, Cook Strait, New Brighton, off Banks Peninsula, Snares. Breeding place unknown, possibly Snares (Fleming).

Southern coast of Australia from Bunbury, Western Australia to Garie, New South Wales, Tasmania.

References.—Mathews, Birds Austr., 2, 77, 1912 (*P. reinholdi huttoni,* Snares). Serventy, Emu, 39, 95, 1939. Clark and Fleming, N.Z. Bird Notes, 2, 187, 1948. Murphy Amer. Mus. Nov., no. 1586, 18, 1952.

Short-tailed Shearwater

Puffinus tenuirostris

The Short-tailed Shearwater has been known on its breeding grounds in Bass Strait from the end of the eighteenth century because of its being used as an article of food by both Tasmanian aborigines and Europeans. But it was not described in scientific literature until 1835 when its present name was given to a specimen obtained in Japanese seas where it is a summer visitor. Twelve years afterwards Gould visited its breeding grounds in Bass Strait. It is only an occasional visitor to New Zealand the first specimen on record being found by Sir Walter Buller on the Waikanae beach prior to 1865.

Adult. Upper surface sooty-black. Under surface sooty-brown; under wing coverts greyish. Bill dark slate. Iris brown. Feet grey, outer toe blackish. Bill 31.5-33, wing 260-288, tail 92-110, tarsus 46-53, mid toe 57-61 mm. New Zealand specimens. *Nestling* covered with brown down, paler below.

Eggs. Clutch one, ovoid, white, 73 x 47, 72 x 44 mm. Bass Strait.

Status. Distinguished from the Sooty Shearwater by its smaller size and darker under wing coverts.

Distribution. Specimens have been obtained at Raoul Island, Spirits Bay, Kaipara Heads to Muriwai, Awhitu, Devonport, Firth of Thames, Plate Island, Petane, Kapiti Island, Ohau, Waikanae, Lyall Bay, New Brighton, Birdlings Flat, and Stewart Island where hundreds of birds were cast ashore in October, 1934.

South-eastern Australia and Tasmania northwards to the North Pacific as far as the Behring Sea and eastward to California. Straggler in Western Australia. Breeds on the islands of Bass Strait, and on the coast of South Australia, Victoria and Tasmania.

The Short-tailed Shearwater apparently migrates from its breeding grounds in Australia and Tasmania along the western side of the Pacific to the northern hemisphere, where it stays during the southern winter. Many examples have been taken off the coast of California.

Nesting. The Short-tailed Shearwater breeds in immense colonies on the islands in Bass Strait honeycombing the ground with burrows up to seven feet in length. It arrives during the last week of September and soon begins clearing out the old burrows and making new ones. It then goes to sea for a time, said by R. H. Davies to be five weeks, returning towards the end of November to lay. The eggs hatch from the middle of January and the young leave the nesting grounds at the end of April and beginning of May. These dates are practically the same as those of the Sooty Shearwater. The period of incubation is about seven weeks.

Commercial use. A flourishing industry is founded on the Tasmanian mutton-bird. The season on the islands of Bass Strait lasts from

March 20th to May 20th. Formerly between 700,000 and 800,000 young were taken in a season, but the supply has gradually decreased until in 1935 the total stood at about 200,000 birds. Eggs are not allowed to be taken on the Bass Strait Islands. The collection of eggs was permitted at Cape Woolamai, Phillip Island, Victoria, where at one time 20,000 could be taken annually, but this locality is now a bird sanctuary. The mutton birding operations as carried out on the Bass Strait islands are similar to those of the Maoris for taking the Sooty Shearwater. But in Bass Strait the usual practice is to salt or pickle the carcases in casks. The birds are shipped to Launceston whence they are distributed, a portion being exported to New Zealand. The oil from the young birds has been refined and placed on the market. It is reputed to contain a large amount of vitamins and to be a remedy for various complaints.

References.—Temminck and Laugier, Planch Col. Ois., pl. 58, 1836 (*Procellaria tenuirostris*, Japanese Seas). Davies, Tas. Jour. Sci., 2, 13, 1843. Gould, Birds Austr., 7, pl. 56, 1847 (*Puffinus brevicaudus*, Bass Strait). Godman, Monogr. Petrels, 149, col. pl. 1907. Littler, Birds Tas., 165, 1910. Hull, Emu, 11, 98, 1911 (*P. intermedius*, Cabbage Tree Id., N.S.W.). Loomis, Proc. Col. Ac. Sci., (4) 2, 138, 1918.

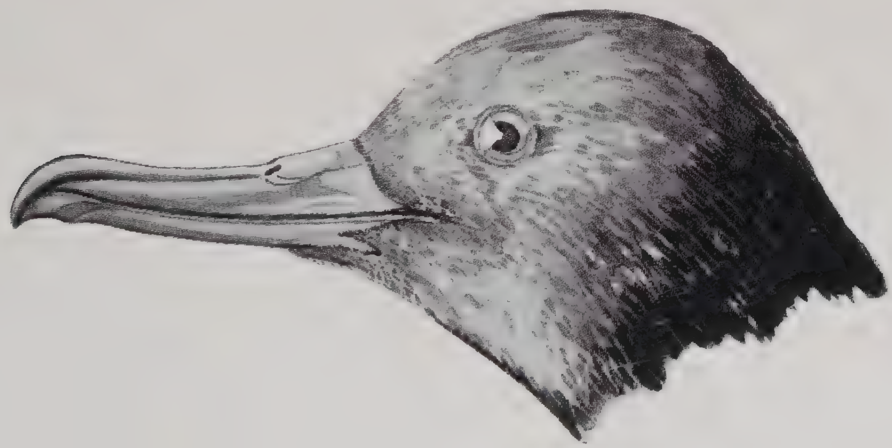
Sooty Shearwater. Titi. Oi

Puffinus griseus

The Sooty Shearwater, or, as it is generally called in New Zealand, the Mutton Bird, was first met with during Cook's first voyage off the coast of Chile. It was later during the same voyage encountered off the East Cape, near the Three Kings and in the Tasman Sea. During Cook's second voyage it was likewise collected in New Zealand waters. It was taken at the Auckland Islands in 1840 by the *Erebus* and *Terror* Expedition and about this time it was known to breed in large numbers on the islets off Stewart Island where the Maoris collected the young for food.

Adult. Upper surface blackish brown, the primaries secondaries and tail black. Under surface greyish brown, pale on the chin and throat, under wing coverts greyish white. Bill dark slaty grey, blackish on the culmen. Iris dark brown. Feet pale lilac, outer side and tips of claws blackish brown. Bill 40-44, wing 283-312, tail 80-94, tarsus 53-63, mid toe 62-70 mm. *Nestling*. First down grey. Second down begins to appear when the chick is about ten days old. A Mangere Island (Chathams) nestling in second down is smoky brown, lighter below.

Colour varieties. When I was in Stewart



E. H. Atkinson

SOOTY SHEARWATER

L. E. Richdale

SOOTY SHEARWATER

Island Mr. T. Bragg informed me that a cream-coloured young was taken by the mutton-birders in the same burrow in five successive years. This would seem to indicate that an albino may be regularly produced by the same parents. The colour of the parents was not known. Another white specimen was taken on Evening Island off South Cape, and in recording its capture Poppelwell states that his informant says that such aberrant forms are sometimes found about the same spot in successive years. A young bird, a partial albino (now in the Dominion Museum), was captured on Pikomamaku-iti, one of the islets off Stewart Island. With the exception of a portion of the back, wings, and the whole of the abdomen which are normal the bird is white. Poppelwell who recorded this specimen stated that the beak was pinkish white, the eyes greenish and the legs pink.

Another partial albino was obtained at the Snares. The back was almost entirely white and the under surface largely mixed with white. A specimen from Ruapuke Island is greyish brown above, darker on head and wings, and silky grey below.

Loomis records six partial albinos from Californian waters.

Eggs. Clutch one, ovoid, white, 70 x 50, 78 x 51 mm. Campbell Island. 76 x 50, 79 x 48 mm. Chatham Islands. 73.4 x 51, 77.5 x 50.5 mm. Solomon Island.

Status. The Sooty Shearwater is very closely allied to the Short-tailed Shearwater (*P. tenuirostris*) but is distinguishable by its larger size and by the white patch on the under surface of the wing. Subspecies of the Sooty Shearwater have been described but the colours and measurements of birds from every part of the range of the species are so uniform that satisfactory definitions cannot be given. Salvin said that in the Atlantic birds the under wing coverts are grey whereas in the Pacific they are white, but Loomis found both kinds off the coast of California.

Distribution. Breeds on headlands on the mainland in a few localities and on many islands off the coast: Three Kings Is., Cavalli Is., Hen Id., Mokohinau, Bay of Islands, White Id., Whale Id., Alderman Is., Kapiti, Mana Id., Stephen Island, Trio Islets, Banks Peninsula, coasts of Westland and Otago, Chatham Islands, Stewart Island and offlying islets, Solanders and the Snares, Auckland, Campbell, Antipodes and Macquarie Islands. It has been observed near the Bounty Islands.

The Atlantic and Pacific Oceans, breeding in the southern hemisphere and ranging northwards during the southern winter to Labrador, Greenland, the Faroe Islands, the Kurile Islands, Kamchatka and Alaska. The species does not occur in the Indian Ocean and is found only sparingly in the west Tasman Sea. Beyond New Zealand it breeds in New South Wales, Tasmania, the Andes of Northern Chile, on islands off Cape Horn, and in the Falkland Group.

Migration. The Sooty Shearwater, so far as is known, breeds only in the southern hemisphere during the southern summer. It then migrates to the northern hemisphere where it is found mainly during the northern summer months. Apparently there is a migration route on either side of the American continent and the New Zealand birds join the west American migration. Voyagers encountering them have reported that they may cover an area of forty square miles.

Sooty Shearwaters arrive in New Zealand waters towards the end of September. One observer reports an unbroken line off the east coast of Otago on October 11th. The first birds to arrive are evidently a mixed lot as some are the breeding birds of the year, others, though they may clean out the burrows, do not breed that year. These non-laying birds are called by Richdale "unemployed." The northward migration begins about the end of March. An endless stream, writes Richdale, was seen off Otago Peninsula on April 11th. He further states that according to his observations the flight, during the first three or four weeks, is made up chiefly of unemployed birds. Richdale's conclusions thus refute several popular beliefs about the order of migration. The chicks are gradually deserted during April and by the middle of May there are practically no Sooty Shearwaters left in the New Zealand region. Numbers have been sighted passing north off the Ninety Mile Beach, Auckland, on May 11th.

The Sooty Shearwater arrives off the California coast in large numbers during the latter part of April and in May and are very abundant until late autumn (October). Some are present during every month of the year.

Habitat. The breeding stations of the Sooty Shearwater extend from the Three Kings in south latitude 34° to Macquarie Island in 55° though the greatest concentration is about Stewart Island and the Snares, 46° 30′ to 48°. In the southern summer this species has been sighted in large numbers in 64° south and in the northern summer both in the Pacific and the Atlantic it has been observed north of 60° north latitude. The life of the Sooty Shearwater is spent mainly on the ocean. It comes ashore on the breeding grounds between September and May though during this time it obtains its food at sea, probably going hundreds of miles from its breeding site to search for pelagic animals. It comes ashore to its nests in the evening, the greater number arriving between nine and ten o'clock. At the Snares, however, Richdale has seen Sooty Shearwaters landing in bright sunlight.

The landing of Sooty Shearwaters on Whero Island is thus described by Richdale: "The nightly homecoming of countless numbers of petrels on these bird islands of New Zealand, and elsewhere, is one of the marvels of the world. An observer seated on shore will notice, shortly before 9 p.m. in mid-summer, the birds collecting in hundreds on the water off shore. Soon they rise and commence to circle the island or the area containing their burrows. As one watches a thud is heard followed by a soft rustle—the first mutton bird has arrived. More and more land, until by 9.30 p.m. the noise of their landing is like the pounding of large-size hail on the ground. The air is alive with mutton birds twisting and turning in all directions. For the first forty minutes the inrush is hectic, but gradually arrivals become fewer until by midnight only an occasional bird may be seen in the air."

The Sooty Shearwater congregates in immense flocks. The birds fly low and sometimes travelling parties which appear to be miles long are encountered. They are good divers and as the boat passes through a resting flock numerous individuals are seen suddenly to appear from beneath the surface and fly off with the others.

Voice. As is the case with several of the species of *Puffinus,* the Sooty Shearwater makes a weird growling or groaning noise, the syllables alternating with the expiration and inspiration of the breath. Some ornithologists have tried to put down their cry in writing and of these I think the best attempt is that of Fleming as heard in the Chatham Islands: Ku-ah-ku-ah-ku-ah-kua-krek. "This cry is begun slowly but becomes excited and faster in the last syllables, whilst the 'krek' is a long drawn and nasal cackle." Apparently the "ku" is made by the outgoing and the "ah" by the incoming breath. In the daytime there is sometimes heard a crooning note coming from the burrows.

Food. The usual food is cephalopods, crustacea and fish which are gathered from the surface of the sea and by diving. The shearwaters consort with the white-fronted tern, the two species feeding together, the terns sometimes in large numbers though never so numerous as the shearwaters. Their method of fishing is quite different for while the terns hover over the water and dive into it, the shearwaters swim on the surface and beneath it. The young are fed on regurgitated oil digested from the fish eaten by the parents.

Nesting. In the Stewart Island area the Sooty Shearwater arrives for breeding during the latter part of September. They come ashore in October and at once begin cleaning out and occupying the burrows. On the headlands of Stewart Island and on the numerous offlying islets the peaty ground is undermined with innumerable burrows. The evidence of the mutton-birders who, for instance, find an albino in the same burrows during several successive years, indicates that the same parents occupy the same burrows year after year.

No one has studied the breeding habits of the Sooty Shearwater so carefully and intensively as has L. E. Richdale who spent a total period of several months, often alone, on the islets off Stewart Island. His account is therefore the source of the following particulars. On Whero Islet the burrows are found only in the sedge and Stilbocarpa areas where the soil is deep (up to eighteen inches). The burrows are one to four feet in length and at the end is the breeding chamber containing the nest which is roughly constructed of leaves and other portions of plants. The eggs, one in each nest, are laid during a twenty-one day period including the last two weeks of November and early December. Both parents take part in incubation. Sometimes the sitting bird is left for as long as two weeks without receiving any food. Richdale says that there is evidence to show that the parent that is absent may go as far as 600 miles before returning to the sitting bird. The chicks are hatched mainly during the three weeks following January 17th. Richdale gives definite hatching dates for 59 eggs, namely, January 17th to February 4th. The period of incubation is thus eight weeks. The chicks begin to leave their burrows during the third week of April and by May 12th all that are strong enough have left. Out of the burrow they may remain on the ground up to fourteen days before flying. The chicks thus remain in the burrows for an average

L. E. Richdale

SOOTY SHEARWATER CHICK

period of 97 days. Richdale gives 86 to 106 days. Feathers begin to appear in the fifth week. "Before leaving, the almost fully-fledged chicks spend some time, mainly on dark, misty nights, out of the burrow, exercising their wings. Then at the approach of daylight they re-enter the burrows. Suddenly, one night, they are overcome by an impulsive urge which induces them to take wing, and they find themselves over the wide, watery wastes."

The time of breeding in the regions both north and south of Stewart Island is not any different from the dates ascertained by Richdale.

Maori. The Sooty Shearwater, or New Zealand mutton bird, forms the basis of a considerable industry in which the Maoris of the southern part of New Zealand are interested. At present about 250,000 young birds are annually collected and preserved. While the birds are for the most part eaten by the Maoris, they are exported to and exposed for sale in various towns in New Zealand where a certain number are purchased by Europeans. The internal fat is extracted by the mutton-birders and sold for soap-making, lubricating oil and other purposes. The feathers are also sold to Europeans.

When the Maori owners on June 29th, 1864, ceded Stewart Island to the Crown, certain islands were reserved under the protection of the New Zealand Government for the purpose of taking mutton birds. Definite localities were assigned to different owners and in the case of disputes the parties may argue over relationships dating back several generations. The rightful owners were determined at sittings of the Native Land Court in 1910 and 1922. The descendants of the original Maori owners are the only persons entitled to take mutton birds, but their wives or husbands are permitted to go with them even if they are Europeans. Regulations now govern the time the islands may be visited, procedure, and other matters considered necessary to safeguard the breeding grounds.

Mutton birding is not permitted before April first, though the birders move to the grounds with their gear about ten days before this date. For the first four weeks or so the young birds are captured in their burrows by thrusting in the arm. If the birder is unable to reach the chick a hole is dug above the place where the nesting chamber is reckoned to be, the bird taken out, and the hole carefully plugged with the sod that was removed. Towards the end of the season, that is during the first three weeks of May, the birds are taken at night time being enticed out of their burrows by lighted torches made of totara bark (nowadays electric torches are used). The birds are usually killed by a blow on the head with a stick, care being taken not to injure the body.

The down and feathers are then removed by plucking and dipping into boiling water and the birds hung up for a night. Next day the wings, legs and head are cut off and the birds split open, cleaned and dry salt rubbed in. In this condition they are packed in casks for another day. Finally they are transferred to bags made from split thallus segments of the bull-kelp (*Durvillea antarctica*) the bottom parts of which are packed in flax baskets and the whole protected with totara bark. Preserved in this manner the birds will keep for a year or more.

A second method of preserving the birds is to cook them in their own fat. After the birds have been plucked they are split open and the inside, including the ribs and lower part of the backbone, are removed. The carcases are then boiled in their own fat for about an hour. They are then taken out, cooled, and packed in kelp bags (nowadays in tins) and covered with warm fat. Thus preserved they will keep for a very long period.

Preserved birds are cooked by boiling until they have softened and the salt has been removed. They may then, if desired, be roasted.

At the present time over 300 persons are employed in the mutton bird industry from which they derive a substantial income.

A detailed illustrated account of the

mutton birding operations has been published by Richdale (*Maori and Mutton Bird*).

References.—Gmelin, Syst. Nat., 564, 1789 (*Procellaria grisea,* New Zealand). Buller, Birds N.Z., 317, 1873; 2nd ed., 2, 232, 1888. Godman, Monogr. Petrels, 145, col pl. 1907. Cockayne Bot. Surv. Stewart Id., 37, 1909. Turner, Wanderlust Mag., 2, 55, 1930. Murphy, Ocean Birds, S. Amer., 2, 666, 1936. Fleming, Emu, 38, 401, 1939. Richdale, Emu, 42, 94, 1942. Richdale, Condor, 46, 93, 1944; 47, 45, 1945. Richdale, Maori and Mutton Bird, 1946. Wilkinson, Kapiti Bird Sanct., 121, 1952. Richdale, Ibis, 96, 586, 1954.

Bullers Shearwater

Puffinus bulleri

Until recently this species was considered to be one of the rarest of sea birds. The first specimen recorded was found by Sir Walter Buller on the beach at Waikanae in 1884. On this specimen and another of unknown locality Salvin described the species. During the next thirty-one years only a few more specimens were obtained in New Zealand and then W. M. Fraser discovered it nesting in burrows on the Poor Knights Islands. In the meantime it had, strange to say, been discovered in fair numbers off the coast of California.

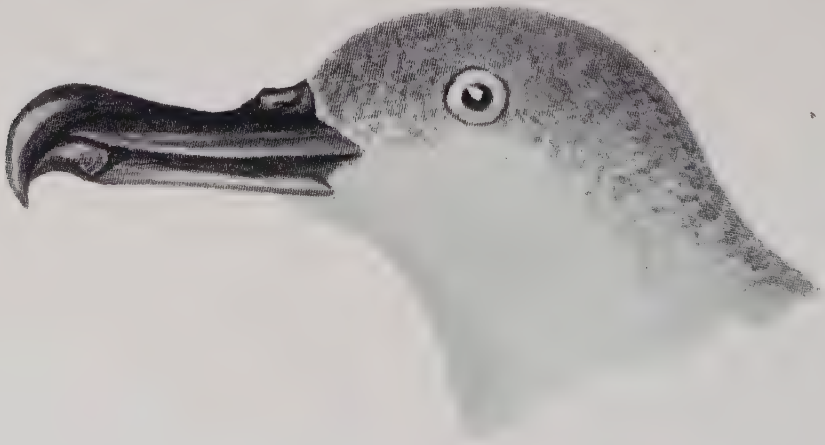
Adult. Upper surface dark slaty grey, crown, nape and marginal wing coverts sooty brown, feathers of back, upper tail coverts, secondaries and their coverts edged with greyish white; primaries and tail black. Under surface white. Bill bluish black, edge of mandibles bluish grey. Iris dark brown. Feet fleshy white, outer side brownish black. Bill 38.5-44.5, wing 280-296, tail 124-130, tarsus 49-56, mid toe 61-68 mm. *Nestling* light grey, slightly paler below. Bill and feet lighter than in adult.

Eggs. Clutch one, ovoid, white, 71 x 45, 68 x 43.6, 63 x 41.5 mm. Poor Knights.

Status. Easily distinguishable from other New Zealand shearwaters by its grey colouration above and white below in conjunction with its cuneate tail. Its nearest ally is the Wedge-tailed Shearwater.

Distribution. Common off the Three Kings and the east coast of the Auckland Peninsula and in the Bay of Plenty. Breeds on the Poor Knights and Whale Island and possibly on the Three Kings and Mayor Island. Specimens have been obtained from Mokohinau, west coast of Auckland, New Plymouth, Waikanae, Kapiti Island, Cook Strait (north side), Tory Channel, New Brighton, Akaroa and near the Chatham Islands.

During the non-breeding period, latter part of March to mid-August, Buller's Shearwater is to be found in the seas immediately to the north of New Zealand. The



C. McCann

BULLERS SHEARWATER

Poor Knights *C. A. Fleming*
BULLERS SHEARWATER

birds found in the eastern Pacific from Chile to California are probably annual migrants from New Zealand.

Food. Falla found the remains of crustacea and cephalopods in the stomachs of specimens that he examined. Small pelagic fishes also form part of the food of this species.

Nesting. On the Poor Knights the burrows are found mostly on slopes facing the sea, but a few were found by Falla under roots a third of a mile inland. Some birds breed in rocky crevices but most make burrows three to four feet in length and near the end is placed the nest consisting of twigs, roots and leaves. Beyond the nest is enough space for the bird to turn round. In some of the burrows the tuatara is found, the relation between bird and reptile usually being not amicable but apparently one of mutual toleration. Occasionally the tuatara may eat a young petrel, but as the reptile feeds at infrequent and often long intervals, little damage is done. Falla states that a tuatara even when hard pressed was unwilling to approach a sitting shearwater.

Buller's Shearwater arrives off the Poor Knights during the latter part of August and in September. Preparation of the burrows takes place during October and November and egg laying begins approximately on November 27th. The chicks are hatched about the end of December and downy young leave the nests during the latter part of March.

References.—Salvin, Ibis, 1888, p. 354 (*Puffinus bulleri,* New Zealand). Buller, Birds N.Z., 2nd ed., 2, 240, col. pl. 1888. Godman, Monogr. Petrels, 81, col. pl., 197. Sandager, Trans. N.Z. Inst., 22, 291, 1890 (*P. zealandicus*). Falla, Emu, 24, 37, 1924; Rec. Auck. Mus., 1, 250, 1934. Buddle, Emu, 41, 61, 1941. Murphy, Ocean. Birds S. Am., 2, 664, 1936.

Wedge-tailed Shearwater

Puffinus pacificus (semispecies)

The Wedge-tailed Shearwater was discovered in the Society group during Cook's first voyage. The species breeds plentifully in the Kermadec Islands whence specimens were first forwarded by Thomas Bell in 1890. Kermadec birds are on an average larger than those from any other group of islands where the species is found.

Adult. Upper surface sooty brown, the feathers of the back and wings edged with lighter brown, primaries and tail black. Chin, throat and foreneck brownish grey, remainder of under surface dusky brown. Bill dark lead colour, tip black. Iris black. Legs pale lead colour, feet fleshy white, toes white. Bill 39.5-44.2, wing 300-327, tail 139-142, tarsus 47-53.4, mid toe 64-66 mm. *Nestling* covered with long dark ashy grey down, the breast and throat paler. Kermadec Islands, adults and nestling.

Eggs. Clutch one, elongate-ovoid, pointed,

Raoul Island *W. R. B. Oliver*
WEDGE-TAILED SHEARWATER
FLEDGLING

white, 69.5 x 44, 66.5 x 44.5, 64.5 x 42.5, 62 x 43 mm. Raoul Island.

Status. The Wedge-tailed Shearwater breeding on the Kermadecs can be named *Puffinus pacificus* in a different sense from that used by Murphy. Two subspecies are accepted by Murphy based on average size, the Kermadec, Norfolk Island and Kandavu specimens being placed under *P. p. pacificus,* all the rest under *P. p. chlororhynchus.* His figure 3, however, shows that there is no more reason to select Kermadec, Norfolk Island and Kandavu birds for a large subspecies than there is to select say Seychelles and Phoenix Island birds for a small subspecies (which Murphy does not do). The different average sizes in different island groups makes an interesting study but the figures so far assembled by Murphy give no justification for birds of any one or more groups to be separated as subspecies. Furthermore Murphy adopts Mathews' dictum that Gmelin's type came from the Kermadecs, though he does not believe it. Cook, on his first voyage, passed through the Tuamotu and Society groups but did not go nearer the Kermadecs than New Zealand where the Wedge-tailed Shearwater has never been taken. I said in my first edition and have repeated it above that the first specimen of the Wedge-tailed Shearwater was collected in the Society group, and it is practically certain that this is correct. Accepting this, and treating all the dark coloured birds as a single species or semispecies, we have two species, one dark (*P. pacificus*) and the other pied (*P. cuneatus*). They have different areas of distribution and interbreed when they come together producing an intermediate colour which Murphy calls "masked white." Murphy accepts two subspecies of dark coloured birds but suppresses the pied birds nomenclaturally treating them as colour phases of his smaller dark coloured subspecies *P. p. chlorohynchus.*

By reason of its wedge-shaped tail and dark colouration this species should not be confused with other species in the New Zealand region. It is nearest related to Bullers Shearwater, and the light phase of the Wedge-tailed Shearwater comes very near to that species but has the upper surface brown instead of ashy grey.

Distribution. Breeds in immense numbers in the Kermadec Group.

The tropical and subtropical portions of the Indian and Pacific Oceans. The species does not appear to be migratory, the individuals of each colony so far as is known frequenting the adjacent seas. Breeds at the Seychelles, Mauritius, Australia, Lord Howe Island, Norfolk Island and throughout the Pacific from the Marianas to Hawaii and the Revillagigedo Islands.

Voice. The noises made by this bird during the breeding season are so strange and weird as to require special mention. Many of them are best likened to the growls and snarls of fighting cats and like them are continuous, a deep growl made by the expiratory breath alternating with a shorter and higher snarl made during inspiration. It is almost impossible to describe the uncanny sounds issuing from a colony of Wedge-tailed Shearwaters quarrelling over breeding sites.

Nesting. The Wedge-tailed Shearwaters or "Black Burrowers" as they are called on Raoul Island, arrive in immense numbers about the middle of October. From about the twentieth they come ashore in the evening and at once begin the business of claiming and clearing out the old burrows or making new ones, this work being done to the accompaniment of much fighting and noise. All night long their weird cries may be heard. After preparing their burrows which might be two or three feet or more in length, they depart for the sea for one or two weeks and then come in to lay. The great bulk of the eggs are laid in early December. The young are mostly hatched by the end of January. Some are hatched later than others for in April young with quill feathers only and others almost fully fledged are found. The young birds leave the nesting grounds in May. Some young birds not long dead have been found on June 6th. The adults leave before the young which, as their hunger increases, come out of their burrows and walk towards the edge of the cliffs. Many fall into the sea and perish but most make their first flight successfully. In 1910 Mr. R. S. Bell, of Raoul Island, reported that many eggs were laid on the surface of the ground but explained that in the previous year a storm filled up many burrows with sand and rocks which set so hard that the birds could not burrow.

In some of the colonies of the Wedge-tailed Shearwater on Raoul Island the soil is completely turned over once a year and this has the effect of almost killing the vegetation. Shrubs and small trees lose their leaves and look as though they were dead. In August, however, dense growths of young shoots cover the trees and shrubs while a rank undergrowth springs up.

References.—Gmelin, Syst. Nat., 560, 1789 (*Procellaria pacifica,* South Pacific). Buller, Birds N.Z., 2nd ed., 2, 235, 1888. Godman, Monogr. Petrels, 84, col. pl., 1907. Iredale, Emu, 10, 11, 1910. Murphy, Am. Mus. Nov., no. 1512, 1951.

Mediterranean Shearwater

Puffinus diomedea borealis

This species is admitted to the New Zealand avifauna on the evidence of a specimen found on the beach near Foxton by Major R. A. Wilson in January, 1934. This specimen belongs to the subspecies *borealis* and is preserved in the Dominion Museum.

Adult. Head and back dark brown, the feathers with light edges, upper tail coverts with wider mottled whitish tips; primaries, secondaries and scapulars blackish with the inner webs lighter and white towards the base; primary coverts black; tail black. Under surface white including the wing lining and axilaries. Bill 55, wing 370, tail 132, tarsus 56, mid toe 68 mm. New Zealand specimen. Bill dull yellow, darker towards the tip. Iris dark brown. Feet pale pink with outer toe and webs dusky. Madeira. Measurements (by Murphy and Chapin) of 50 males from Azores. Bill 51-59, wing 329-367, tail 122-140, tarsus 54-59, mid toe 67-74 mm. Females are slightly smaller.

Eggs. Clutch one, form variable, surface slightly pitted, white. 73 x 50, 72 x 51.5, 76 x 50 mm. Pico, Azores. (Murphy and Chapin.)

Subspecies. Three subspecies are recognised. *P. d. diomedea.* Mediterranean Sea. Size intermediate. Bill 44-56, wing 312-347 mm. *P. d. borealis.* Atlantic and South Indian Oceans. Breeding on Azores and Canary Islands. Size largest. Bill 48-60, wing 322-372 mm. Crown and sides of head darker than in *P. d. diomedea.* Inner webs of primaries dark, showing no white beyond the under wing coverts. *P. d. edwardsi.* North Atlantic breeding on Cape Verde Islands. Size smallest. Bill 38-50, wing 277-327 mm.

Distribution. Foxton. One occurrence. North Atlantic Ocean. Breeds on the Azores, Madeira, Salvage, Canary and Berlengas groups. Cape seas and South Indian Ocean where probably it is a regular visitor. Straggler as far eastward as New Zealand.

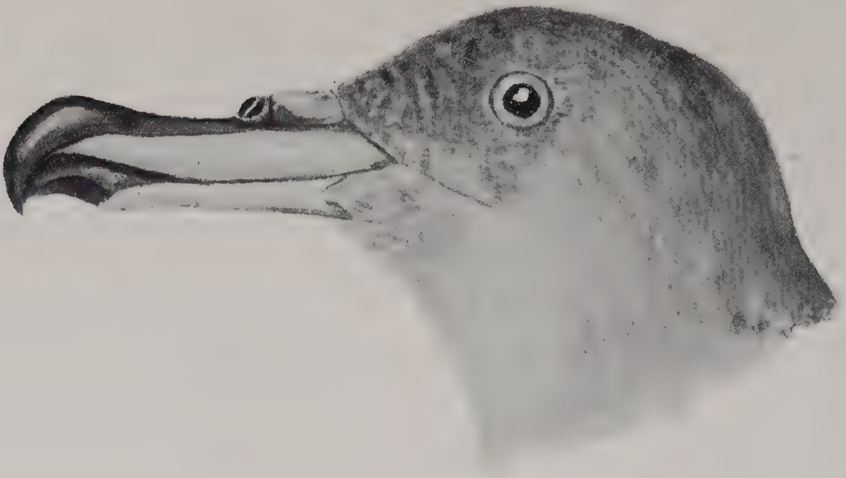
Nesting. The Mediterranean Shearwater breeds near the sea under rocks and in caves, occasionally in burrows. Generally the eggs are laid on the bare ground but sometimes a little material is used in the nest. The birds arrive at their breeding places in the Azores in March; eggs are laid towards the end of May. Half grown chicks in down were taken on the Great Salvage Islands on September 23rd, and nearly fully fledged birds with down on breasts and bellies were taken on October 3-8.

References.—Scopoli, Ann. Hist. Nat., 74, 1769 (*Procellaria diomedea,* Mediterranean). Cory, Bull. Nutt. Orn. Club., 6, 84, 1881 (*Puffinus borealis,* Massachusetts). Godman, Monogr. Petrels, 94, 1908 (coloured plate is of subsp. *borealis*). Murphy and Chapin, Amer. Mus. Nov., 384, 3, 1929. Oliver, Emu, 34, 23, 1934 (Foxton).

Flesh-footed Shearwater. Taonui

Puffinus carneipes hullianus

The Flesh-footed Shearwater was first obtained off the Three Kings Islands during Cook's first voyage. The next record is that of Gould who in 1844 bestowed its present


C. McCann

FLESH-FOOTED SHEARWATER

specific name on specimens from Western Australia. It was not definitely recorded from New Zealand until 1888 when Salvin recognised a specimen in Buller's collection. The same year Buller included the species in the second edition of his work stating that it was common off New Zealand.

Adult. Upper surface sooty black, darker on the head; the feathers of the back, scapulars and wings with brown margins. Under surface brown, the sides of the face and throat tinged with grey. Bill pale flesh, the culmen and tips of both mandibles brown. Iris brown. Feet flesh colour, webs pale brown. Bill 38-44, wing 313-336, tail 108-119, tarsus 49-56, mid toe 63-68 mm. *Nestling.* Sooty grey above, whitish below. Bill bluish slate, darker at the tip. Feet bluish slate. Chicken Islands. The first down is lighter in colour.

Eggs. Elongate-ovoid, white, 73 x 46, 72 x 44.5 mm. Karewa.

Status. The stout bill with elevated nasal tubes and large unguis in conjunction with the dark plumage and rounded tail distinguish this species from its allies. Two subspecies can be recognised though they are very closely related. *P. c. carneipes.* Bill less robust and average wing length less, 307-325 (av. 316.2) mm. Indian Ocean, breeding in south-west Australia. *P. c. hullianus.* Bill more robust and average wing length greater.

Distribution. From Cook Strait northwards, breeding at Three Kings (probably), Hen and Chickens, Mercury Islands, Alderman Islands, Karewa and on islands off Marlborough Sounds. It has also been obtained or observed at Mokohinau, Little Barrier Island, west coast of Auckland, Mayor Island, Kaikoura, Banks Peninsula, and east of the Chatham Islands.

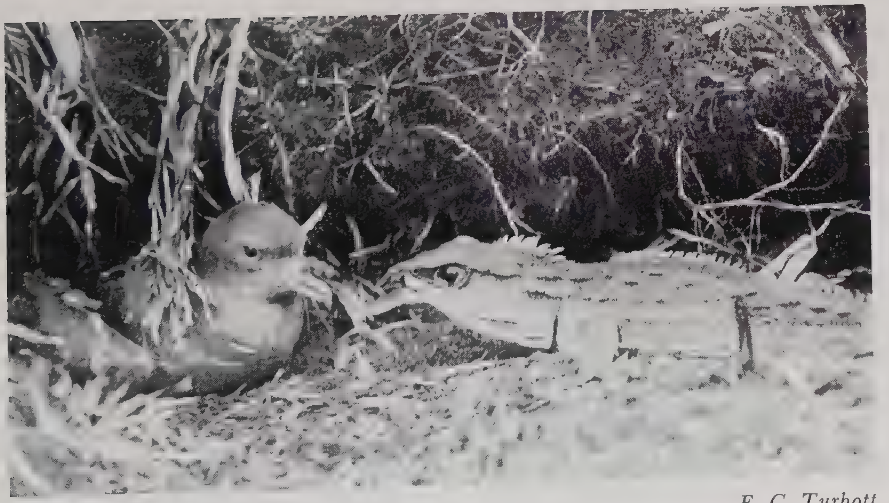
Pacific Ocean from eastern coast of Australia to Chile and northwards on migration to Japan and British Columbia. Breeding in Lord Howe Island.

The Flesh-footed Shearwater apparently regularly migrates between Australian and New Zealand seas in the south and Japanese seas in the north. It is absent from New Zealand from June until August. It breeds in the southern area during the southern summer and then migrates, passing a portion of the year (during the southern winter) in the north. In the eastern North Pacific it appears to be a regular but not a common visitor off the coast of California and British Columbia.

Food. Crustacea, squids and small fishes. gathered from the surface of the sea, are

G. A. Buddle

FLESH-FOOTED SHEARWATER



Hen Island *E. G. Turbott*

FLESH-FOOTED SHEARWATER AND TUATARA

known to be eaten by the Flesh-footed Shearwater.

Nesting. Karewa Island is the headquarters of the Flesh-footed Shearwater in the Bay of Plenty. Here on a small rocky islet the soil clings at a steep angle to the surface of the rocks, and a tangled scrub, mainly composed of taupata (*Coprosma repens*) clothes the hillside. Underneath this the undergrowth is kept down by the burrows of birds, for every available space is riddled with them and one's foot may suddenly break through the surface at any step. Also occupying burrows are tuataras (*Sphenodon punctatum*), sometimes the reptile and bird being found in the same hole. The Flesh-footed Shearwater congregates in the Bay of Plenty towards the end of September, but the eggs are not laid until late in November or early in December. The burrows are two or three feet long and the single egg is deposited in an enlarged space at the end. The young are hatched about the first week in January and remain in the burrows until the end of April or beginning of May.

Maori. The Taonui, as well as the Grey-faced Petrel, is taken by the Maoris for food from islands in the Bay of Plenty.

References.—Gould, Ann. Mag. Nat. Hist., 13, 365, 1844 (*P. carneipes,* Western Australia). Buller, Birds N.Z., 2nd ed. 2, 234, 1888. Codman, Monogr. Petrels, 142, col. pl., 1907. Falla Rec. Auck. Mus., 1, 249, 1934. Hindwood, Emu, 44, 241, 1945.

Genus Procellaria

Bill long, stout, unguis large. Nasal tubes raised, short, bevelled in front, aperture directed forwards, septum wide. Tail rounded, rectices 12.

Procellaria is allied to Puffinus coming near to the section Ardenna, but the bill is relatively stouter and the nasal tubes higher and longer.

Three species are included in the genus. All are large-sized birds and range over the southern oceans.

Key to Species

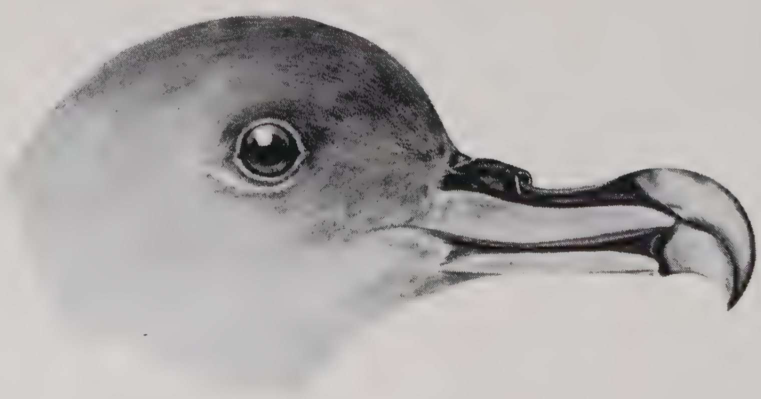
Grey above, white below .... *P. cinerea*
General colour black.
  Smaller. Bill 39-43 mm. No
    white .... *P. parkinsoni*
Larger. Bill 48-56 mm.
    No white .... *P. a. westlandica*
    White on chin, occasionally
      none .... *P. a. aequinoctialis*

References.—Linne, Syst. Nat., 10th ed., 131, 1758 (*Procellaria,* type *P. aequinoctialis,* L.). Reichenbach, Nat. Syst. Vog. iv, 1852 (*Majaqueus,* same type). Bonaparte, Compt. Rend., 43, 595, 1856 (*Adamastor,* type *P. cinerea,* Gmel.)

Grey Petrel

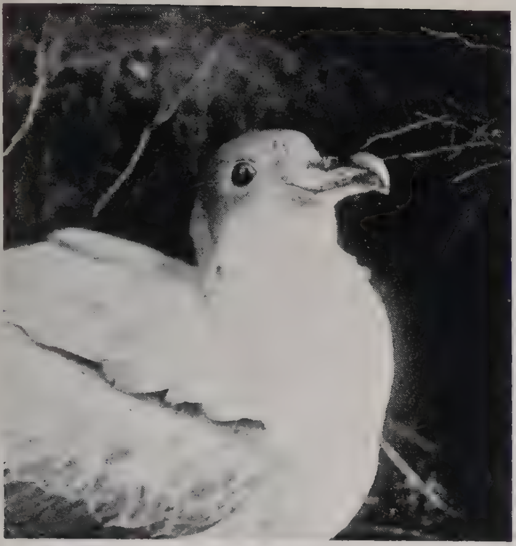
Procellaria cinerea

The Grey Petrel was discovered in the seas adjacent to New Zealand by the Forsters during Cook's second voyage. Latham described it from Forster's drawing as the Cinereus Petrel and Gmelin converted this to its present scientific title. This species was first included in the list of birds in-



Lily A. Daff

GREY PETREL



Campbell Island *J. H. Sorensen*

GREY PETREL

habiting New Zealand by Hutton in 1870 although he had then not obtained a specimen. The first record of specimens actually taken off the New Zealand coast is that by Buller who received two shot by Captain Fairchild in 1892 between Wellington and the Chatham Islands. It has generally been considered a scarce straggler but in 1927 I noticed it at sea constantly when visiting the islands to the south of New Zealand and it is known to breed on the southernmost groups.

Adult. Above ashy grey, darker on the crown, wings, tail and rump, the wing coverts with hoary grey margins. Sides of face and neck pale grey. Under surface white; the long under-tail coverts ash-brown. Bill black on ridge, horn colour at hook, sides bluish grey, with black sulcus in lower mandible. Iris dark brown. Feet greyish flesh colour, brown on outer side, webs yellowish. Bill 44-50. wing 335-359, tail 110-120, tarsus 55-61, mid toe 71-80 mm. Macquarie and Antipodes Islands.

Eggs. Clutch one, both ends equally rounded, dull white, smooth, pitted, 78 x 49.5 mm. Macquarie Island. 78 x 53, 69.5 x 50 mm. Antipodes Island.

Distribution. Common in the seas to the south of New Zealand; occasional off the coast of the main islands. Breeds at the Campbell, Antipodes and Macquarie Islands. Specimens have been obtained between Wellington and the Chatham Islands, in Wellington Harbour, on Kapiti and on Muriwai beach (west of Auckland).

The southern oceans between 30° and 55° South latitude, but extending northwards along the west coast of South America to Peru and straggling to California and Ascension Island. Breeds at Kerguelen, Tristan da Cunha and Gough Island.

Food. The Grey Petrel, like many of the species of Puffinus, takes its food in the open sea by diving. It uses its wings under water much in the same manner as when flying and reappears with the wings still spread. Falla records beaks of cephalopods in stomachs from Kerguelen Island birds.

Nesting. On Mount Eboule, Campbell Island, on June 25th, Sorensen found well formed nests of the Grey Petrel made of dry fern and tussock. In the summer the burrows are used by Sooty Shearwaters (*Puffinus griseus*) and, except for a little enlarging and cleaning nothing is done to them by the Grey Petrels. The burrow usually runs straight for about two feet and then turns at a right angle for another two and a half feet and ends in a chamber about eighteen inches in diameter. The nest is but slightly raised above the floor of the terminal chamber.

The Grey Petrel is a winter breeder. An egg was found on Campbell Island on June 3rd. Eggs have been found on Tristan da Cunha in April and on Gough Island in May.

References. Gmelin, Syst. Nat., 563, 1789 (*Procellaria cinerea* New Zealand seas). Buller, Birds N.Z., 305, 1873; 2nd ed., 2, 241, 1888. Godman, Monogr. Petrels, 155, col. pl., 1907. Murphy, Ocean Birds S. Amer., 2, 649 col pl. 1936. Falla, B.A.N.Z.A.R.E., Ser. B, 2, 176, 1937.

Black Petrel, Taiko

Procellaria parkinsoni

The Black Petrel was first met with off the coast of New Zealand during Cook's first voyage, and a drawing was made by Bank's artist, Sydney Parkinson. This suggested the specific name when, in 1862, Gray described the species from a specimen obtained by Miss Rachel Stone. Dieffenbach noticed it about 1840 and in 1868 it was discovered by Hutton breeding on Little Barrier Island.

Adult. Sooty black. Bill bluish white, culmen, lower edge of nasal tubes, tip of unguis and upper part of mandible, including sulcus, black. Iris dark brown. Feet black. Bill 39-43, wing 326-365, tail 93-106, tarsus 49-55, mid toe 62-71 (Murphy). *Immature.* Glossy black. Bill black, horn grey on sides and unguis. Feet black. *Nestling* covered with sooty down.

Eggs. Clutch one, ovoid, white. 70 x 52, 71 x 52 mm. Little Barrier Island. (Sibson.)

Status. Smaller in all dimensions than *P. aequinoctialis.* It agrees with *P. a. westlandica* in having no white anywhere and in this respect differs from *P. a. aequinoctialis* which normally has white patches on chin and face.

Distribution. Found off the coasts as far south as Jackson Bay and Stewart Island, but more common in the north. Breeds on Little Barrier Island, Te Moehau, the Waitakerei and Rimutaka mountains in the North Island, and on the Heaphy Range in the South Island. It probably breeds on several other ranges in the Auckland, Wellington and Nelson provinces. Specimens have been obtained at Great Barrier Island, Mokohinau, Kaipara, Stratford, Lake Taupo, Manawatu, Masterton, Cook Strait, Westport, Punakaiki, Hokitika and Jackson Bay.

An infrequent wanderer to Tasmania and south-east Australia. Three specimens have been obtained in the Galapagos Group which may indicate a regular migration as with the Sooty Shearwater (*Puffinus griseus*). The Galapagos birds were obtained in May, June and October.

Ecology. The Black Petrel is a sea bird apparently preferring the subtropical zone of ocean waters. Perhaps it frequents tropical seas during the southern winter as specimens have been taken in the Galapagos Islands at that time of the year.

It was formerly very numerous during the breeding season on Little Barrier Island. It is now much less common having suffered from the depredations of pigs, dogs and cats introduced by the Maori and European residents.

Food. Buller found in the stomachs of this species blubber-like matter and the beaks of cephalopods.

Voice. The Black Petrel's cry, as recorded by Drummond, is a whistling note which he likened to a combination of a soft whistle and a deep whirr. Sibson heard a somewhat similar note but could not identify the bird. He, however, traced a staccato, rapidly reiterated angry-sounding "Clack, clack clack" to the Black Petrel. One of the Maori names for the Black Petrel, kuia, is evidently derived from the bird's whistling call.

Nesting. The nesting habits of the Black Petrel were investigated by Andreas Reischek on Little Barrier Island in 1882 and on the Waitakerei Ranges in 1884 and since then very little additional information has come to light. Reischek says that on Little Barrier Island he found the birds cleaning out the burrows in November. They were observed digging with their bills and throwing out the earth with their feet. The burrows were situated in forest about 2300 feet above sea level in loose soil, under roots of trees, under stones and in hollow trees. The earliest date on which Reischek found an egg was November 28th. He found chicks in the burrows from about the end of December. The parents leave the young in the burrows during the day time but visit them several times during the night to feed them. The young had become very scarce in April and May.

In the Waitakerei Range 1000 feet above sea level and twelve miles from the ocean Reischek found the female sitting on an egg nearly hatched in December. The burrows were from 8 to 12 inches in diameter and up to two and a half feet long. A carelessly built nest of a few leaves is placed in an enlarged chamber at the end of the burrow. During the preparation of the burrows the birds are found in the burrows during the day time but at night time they go to sea. Incubation is carried out by the female while the male during the day occupies a separate burrow nearby.

Other observations show that the breeding season is somewhat extended. In the Heaphy Range G. Robinson, on December 19th, found Black Petrels in burrows each with an egg. Sibson on Little Barrier Island on December 30th found eggs "laid quite recently." G. Buddle has records of late November or early December as the laying dates on Little Barrier Island but he also found eggs chipped and about to hatch in the second week of February and a small nestling in March. Buller records an egg taken in the Rimutakas on February 1st and there is in the Auckland Museum a young bird partly fledged found in May.

Maori. The Maoris formerly took large numbers of the young of the Black Petrel for food. Each tribe had its own preserve which was visited every year during May. Care was taken not to disturb the burrows, the birds being taken out with a flexible stick split at the end. This was pushed into the burrow until the bird was felt and then twisted in the down and the bird was gently pulled out. It was killed by biting its head, and the stomach, with its oily contents, cut out with the aid of the bird's bill and thrown away. The birds were then plucked, singed, and roasted until the fat was extracted. Afterwards they were placed in a vessel made of totara bark and covered with the fat. Thus preserved they would keep a long time.

References.—Gray, Ibis, 1862, p. 245 (*Procellaria parkinsoni,* New Zealand). Buller, Birds N.Z., 302, 1873; 2nd ed., 2, 242, 1888. Reischek, Trans. N.Z. Inst., 18, 87, 1886. Godman, Monogr. Petrels, 174, col. pl., 1907. Falla, Rec. Auck, Mus., 1, 254 1934. Murphy, Ocean. Birds S. Am., 2, 647, 1936. Sibson, N.Z. Bird Notes, 2, 135, 1947.

Westland Shoemaker

Procellaria aequinoctialis westlandica

This subspecies which has no white on the face was discovered in 1945 by pupils of the Barrytown school, Westland, on the forested hills of the district.

Adult. Entirely sooty black. Bill dull ivory, dark areas on base of nasal tubes, entire culminicorn and dertrum, and mandibular sulcus and gonys. Bill 48.5-51, wing 365-381, tail 112-120, tarsus 63-68, mid toe 85-87 mm. (Falla.)

Eggs. 80 x 53, 85 x 56, 78.5 x 56 mm. Barrytown, Westland.

Status. The constant absence of white on the head combined with winter breeding are the only claims this form has for subspecific recognition. The colour character, however, occasionally breaks down, for a specimen of *P. a. aequinoctialis* from Adams Island has no white on the chin and throughout its range this subspecies may show no white feathers or only a few irregularly disposed on its chin.

Distribution. Known only from Westland. Breeding in hilly forested country inland from Barrytown. Specimen fell on steamer between Lyttelton and Wellington, July, 1954.

Nesting. The Westland Shoemaker breeds at a different time of the year from its white chinned relative. All that is known about its breeding cycle is contained in Falla's account of the discovery of the species in the hilly country inland of Barrytown. He states that on April 27 the burrows had been cleared out and were occupied during the day by pairs and single birds. There were no eggs at this time. Eggs were found on June 15 but Falla thinks they were laid about May 15. Downy young were found in August and fully fledged ones in November. On December 15 a fully fledged bird with some wisps of down on the neck, ready to fly, was found in one of the burrows, most of the other burrows being empty.

Reference.—Falla, Rec. Cant. Mus., 5, 111, 1946 (*P. parkinsoni westlandica,* Barrytown).

White-chinned Petrel. Shoemaker

Procellaria aequinoctialis aequinoctialis

This species, the Cape Hen of sailors, was described as early as 1747 by George Edwards while its scientific name was bestowed by Linne in 1758, the Cape of Good Hope being given as the locality where it was found. In the New Zealand region it was first obtained from the Auckland Islands about 1892 and from the Antipodes two years later.

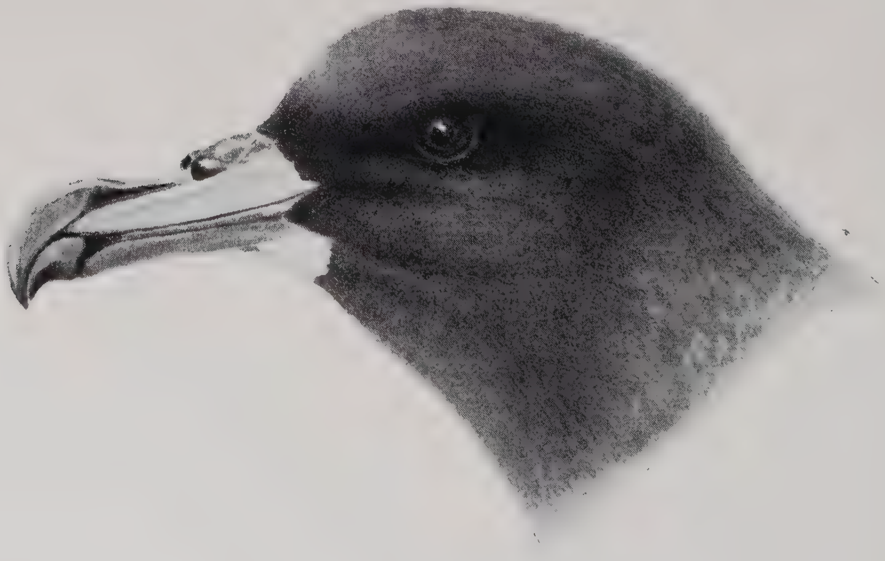
Adult. Sooty black, the chin white. A specimen from Adams Island has no white on the chin. Iris dark brown. Bill bluish horn colour, culmen, tip of unguis and mandibular sulcus black. Feet black Bill 48-56, wing 365-388, tail 104-126, tarsus 58-67, mid toe 78-87 mm.

Eggs. Clutch one, ovoid, white, without gloss, 80 x 55, 83 x 53.5 mm. Auckland Islands.

Status. Differs from the Black Petrel in its larger size. The white marks on chin and face are also, when present, distinguishing characters.

In most cases the Shoemaker has some white on the chin. In some Atlantic specimens the white extends over the sides of the face and on to the crown (*P. a. conspicilata*). In a few cases the birds have no white at all. Murphy says that the original description of the species was based on a figure of a bird without white on the chin. He then records a specimen taken off Valparaiso with no white on the chin, and there is a specimen from Adams Island in the Auckland group, in the Dominion Museum, similarly without white. Murphy points out that no two birds appear to be exactly alike and says further: "The extent of white on the chin is clearly without geographic significance." In view of this it is with some hesitation that I allow the Westland Shoemaker subspecific rank. The relationships of this group of shoemakers would probably best be shown by treating *westlandica, aequinoctialis* and *conspicillata* as subspecies of a single species.

Distribution. Breeds on Auckland, Disappointment and Adams Islands in the Auckland group, and on Campbell, Antipodes and



R. Jacobs

WHITE-CHINNED PETREL

Macquarie Islands. Elsewhere in the New Zealand region it is only an occasional visitor, specimens having been taken at Hokianga, Muriwai, New Brighton, Omarama and the coast of Otago.

The southern oceans from the Antarctic continent northwards to about 30° South latitude and on the west coast of South America to Peru. It is known to breed at South Georgia, the Falkland Islands, the Crozets, Kerguelen and Inaccessible Island.

Habitat. While the Shoemaker ranges widely over the Antarctic and Subantarctic zones its breeding places lie mainly in the Subantarctic belt but extend into the Antarctic area at South Georgia.

Food. Consists mainly of squids, fish and crustaceans.

Nesting. At Antipodes Island the burrows are made on a slope and the nest placed in a circular chamber at the end. The nest is raised several inches from the floor of the cavity leaving a circular channel round it. A single egg is laid in December and the young are fully fledged in May.

Regarding the nesting habits of the White-chinned Petrel at the Auckland Island, E. F. Stead writes: "We first found two nests with hard-sat eggs (February 1st). These were in a hard dry bank, in burrows about three feet long, the nest consisting of a considerable accumulation of dry grass, placed in an enlarged terminal chamber. In the wet peaty bank of a creek nearby we found several more of these nests, but of an entirely different character. The upward sloping burrow opened at its inner end into a chamber about a foot and a half in diameter. The mud from the floor of this chamber had been raked up into a heap in the centre of it leaving a perfectly formed drain all round, from which the water trickled out down the burrow. The nest was built of grass, as before, and placed in a shallow depression in the central heap, two or three inches above the water in the surrounding drain. I later ascertained that the birds build these heaps by standing knee deep in mud in the middle of the nest-chamber and raking the mud inwards with their bills."

Sorensen examined a small nesting colony of the White-chinned Petrel on Campbell Island. He found that the birds reached their burrows through slushy water and that mud and water continually ran from a number of them. One burrow which he excavated ran steeply upwards following closely the slope of the hillside and ended in a chamber about eighteen inches in diameter. In the middle of this was a slightly raised nest with a little *Tillaea moschata* and containing one egg. The bird crouched at the rear wall and fought viciously when removed. This was on February 5th. On February 2nd an egg nearly hatching was taken from a burrow which contained also a bird.

Reference.—Linne, Syst. Nat., 10th ed. 132, 1758 (*P. aequinoctialis,* Cape Seas). Godman, Monogr. Petrels, 169, col. pl., 1907. Mathews, Birds Austr., 2, 114, 1912 (*P. a. steadi,* Antipodes Id.) Murphy, Oceanic Birds S. Am., 2, 641, 1936. Falla, B.A.N.Z.A.R.E., Ser. B, 2, 176, 1937.

GENUS PTERODROMA

Bill short, stout, unguis large, nasal opening short, truncate, with narrow septum and directed slightly upwards. Tail rounded, rectrices 12.

A well-marked genus distinguished by the short stout bill with short nasal tubes with narrow septum. In some of the species, such as *P. cookii* the bill is rather slender, but the nasal tubes are like those of the remainder of the genus. Pterodroma is closely allied to Puffinus but may at once be separated by the stouter bill with larger unguis and the narrow septum to the nasal tube.

About 25 species are recognised. They are most numerous in the temperate and tropical regions of the southern hemisphere but a few species occur in the North Atlantic and North Pacific Oceans.

On account of the diverse attempts at classification of the smaller species of *Pterodroma* that have been made I treat them as separate species.

What is believed to be another species of *Pterodroma* living in the New Zealand

Key to New Zealand Species of Pterodroma

- Under surface white (grey in *P. inexpectata*)
  - Crown of head dark.
    - Back ashy grey.
      - Under surface white.
        - Feet pink, front of toes black.
          - Axillaries white .... *P. nigripennis*
          - Axillaries black .... *P. axillaris*
        - Feet blue.
          - Head ashy.
            - Bill short, rather stout, 23-25 mm. .... *P. pycrofti*
            - Bill long, slender, 26-32 mm. .... *P. cooki*
          - Head black .... *P. leucoptera*
      - Under surface brownish grey .... *P. inexpectata*
    - Back brown or black.
      - Smaller, wing 25 cm. .... *P. alba*
      - Larger, wing 29-30 cm.
        - No white collar .... *P. neglecta*
        - White collar round neck .... *P. externa*
  - Crown of head white .... *P. lessoni*
- Under surface entirely brown.
  - Inner webs of primaries with white base .... *P. solandri*
  - No white on inner webs of primaries.
    - General colour slaty grey .... *P. lugens*
    - General colour sooty brown .... *P. macroptera*

region and as yet unidentified is thus referred to in the New Zealand *Checklist*. The Chatham Island taiko, successively identified as *Pterodroma axillaris, P. inexpectata* and *P. neglecta* (Fleming, 1944, *N.Z. Bird Notes,* 1:58) is believed to be none of these species but a *Pterodroma* similar to *P. macroptera* in shape of cranium, but smaller; it is reputed to have a dark upper breast and white belly.

References.—Bonaparte, Compt. Rend., 42, 768, 1856 (*Pterodroma,* type *Procellaria macroptera* Smith; *Aestrelata,* type *Procellaria haesitata* Kuhl); Compt. Rend., 43, 994, 1856 (*Cookilaria,* type *Procellaria cookii* Gray).

Black-winged Petrel

Pterodroma nigripennis

This petrel was first collected on Raoul Island by T. Bell and was recorded by Cheeseman in 1891 as Cook's Petrel. Shortly afterwards specimens were forwarded to Rothschild who recognised its distinctness and described it, in 1893, under its present name. In December 1945 P. C. Bull found the Black-winged Petrel breeding on the Three Kings Islands.

Adult. Upper surface light ashy-grey, the feathers with pale margins; crown of head darker; long scapulars, a patch on the rump and median upper tail coverts blackish; marginal wing coverts black; greater wing coverts slaty-grey with white margins; primaries black, the greater part of the inner webs white; secondaries grey with white margins; tail slaty-grey, blackish at the end, the outer feathers white mottled with grey. Forehead, front of crown and over eye white spotted with black; a patch round the eye black; below the eyes white spotted with black. Lores cheek and lower surface white; under surface of wing white with a broad slaty black band along the front margin; axillaries white; primaries with a little white at the base of the inner webs. Bill black. Iris dark brown. Feet flesh colour, the terminal part of the webs and inner toes and the whole outer toe black. Bill 23-25.5, wing 223-235, tail 95-107, tarsus 28.5-33, mid toe 34.2-39 mm. *Nestling.* Covered with dove-grey down with the abdomen and a line extending thence to the chin, white. Raoul Island.

Eggs. Clutch one, broadly, ovoid, white, 53 x 38.5, 50 x 38.8 mm., or narrowly ovoid, 51.5 x 36.5 mm. Raoul Island.

Status. Allied to the Chatham Island

Petrel but differs in the greater amount of black on the wings, lower back and tail, the greater extension of grey on the side of the neck, and in the axillaries being white. It is distinguished from *P. hypoleuca* by its slaty crown and white on inner web of primaries.

Distribution. Breeding at the Kermadec Islands (Raoul, Meyer, Macauley, Curtis) and the Three Kings Islands. Straggler found at Waikanae, 1954.

Tubuai Islands, breeding on Bass Rock.

Nesting. The Black-winged Petrel breeds on all the islands of the Kermadec group except French Rock. Its colonies are on slopes near the shores covered with low scrub or Mariscus tussocks, and in the loose soil this species in company with the Wedge-tailed Shearwater makes its burrows. These are two to three feet in length and in each is laid a single white egg. The birds are first heard at night late in October. They land to clean out the burrows about the middle of November and lay in the latter part of December and first half of January. The young birds leave the island at the end of April.

References.—Rothschild, Bull. Br. Orn. Club., 1, 57, 1893 (*Aestrelata nigripennis,* Kermadec Is.); Ibis, 1893, 571. Godman, Monogr. Petrels, 214, col. pl. 1908. Murphy, Amer. Mus. Nov., no. 370, 4, 1929. Mathews, Suppl. Birds Norf. Lord Howe Is., 83, col. pl., 1936. Falla, Emu, 42, 117, 1942. Turbott & Buddle, Rec. Auck. Mus., 3, 323, 1948. Fleming, Notornis, 6, 2, 1954.

Chatham Island Petrel. Ranguru

Pterodroma axillaris

This species was discovered by Hawkins on South-east Island, Chatham group, in 1892, and was described by Salvin the following year. Only a few specimens have since been obtained.

Adult. Upper surface slaty grey with blackish margins to the feathers; the long scapulars and wing coverts blackish; primaries black, white for the greater part of the inner web; outer tail feathers mottled with ashy-brown and white frecklings. Forehead white, mottled with black spots; black patch round eye. Lores, face and under surface white; axillaries and a wide margin on the under surface of the wing black; a white patch on the inner webs of the primaries. Bill black. Feet flesh colour; outer toe and terminal portion of the webs and other toes black. Bill 23.4-25, wing 214-232, tail 92-106, tarsus 28.3-31, mid toe 36-40 mm.

Status. Allied to the Black-winged Petrel from which it may be distinguished by its black axillaries and lighter and more uniform upper colouration. It differs from *P. hypoleuca* by its slaty crown, white on inner web of primaries and black axilaries.

Distribution. Breeds on South-east Island in the Chatham group, where it is seldom seen. Buller records a stray bird from the Wairarapa.

Nesting. Archey and Lindsay stated in 1923 on the authority of H. G. Blyth that this species bred in deep tunnels among the roots of trees on the cliffs of the south-west portion of the main island near the two sharp volcanic cones known as The Horns.

Fleming, in December, 1937, states that the Chatham Island Petrel appears to breed only on South-east Island. A burrow was described as being dry, long and deviating, beginning under a buttress of a tree and winding in and out of its roots at a depth of about two feet. A fair amount of nesting material was found in its terminal portion.

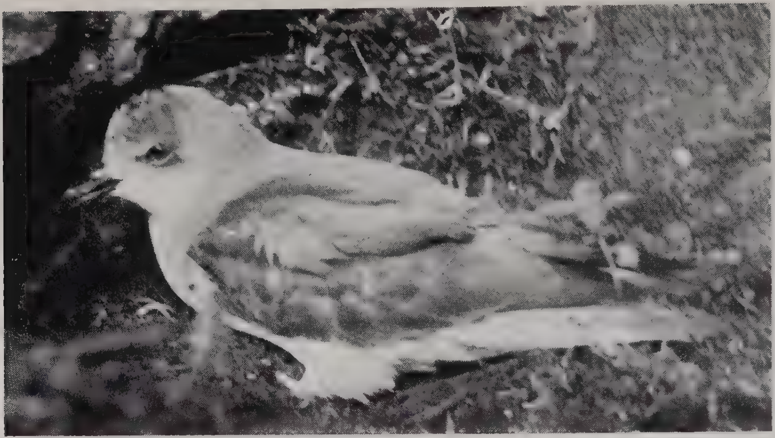
References.—Salvin, Ibis, 1893, p. 264 (*Oestrelata axillaris,* South-east Id.) Cat. Birds Br. Mus., 25, 418, 1896 (col. pl.). Godman, Monogr. Petrels, 252, col. pl., 1909. Mathews, Suppl. Birds Norf. Lord Howe Is., 85, col. pl., 1936. Fleming, Emu, 38, 404, 1939.

Pycrofts Petrel

Pterodroma pycrofti

Andreas Reischek found this petrel on the Chicken Islands in burrows with the tuatara in December 1880 but failed to distinguish it from Cook's Petrel. It was next found by R. A. Falla breeding on both the Hen and Chicken Islands in January 1932 and by him described under its present name. In November 1940 it was discovered by G. A. Buddle breeding on the Poor Knights.

Adult. Upper surface deep grey to blackish grey with darker patches on nape



Hen Island *C. A. Fleming*

PYCROFTS PETREL

and rump, forehead mottled grey and white, the mottling not extending to the crown, front part of lores and narrow line over eye white, feathers in front of eye mottled, those below almost black; wing blackish brown with faint grey bloom on secondaries, inner half of inner webs of primaries white basally; tail dark grey, the central feathers white at extreme base, the white becoming more extensive on each succeeding pair, two outer pairs white with grey patches on outer webs. Under surface including flanks and axillaries white. Wing lining black near the carpel flexure, mottled beyond it. Bill black. Iris dark brown. Feet pale lilac blue, outer toe and patches on inner toes and lower end of tarsus brown, webs flesh colour. Bill 23-25, wing 210-218, tail 86-89, tarsus 25-30.5, mid toe 31-36 mm.

Eggs. Clutch one, ovoid, white, 46.8 x 36, 47.8 x 35 mm. Chicken Islands. 46 x 36, 48 x 36, 52 x 38 mm. Hen Island.

Status. The short bill and blue feet ally this species to *P. leucoptera* but it is slightly lighter in coloration; for example, the sides of the breast are dark grey whereas in *P. leucoptera* they are black, and the crown and nape in *P. pycrofti* are a little lighter than in *P. leucoptera,* but the back and wings are identical in colour.

Distribution. Auckland Province, breeding on Hen and Chickens and the Poor Knights. Birds have been picked up on the mainland at Cape Maria van Diemen and Mangowai.

Voice. According to Fleming two types of cry, differing in pitch, may be distinguished. One is a soft ti-ti-ti-ti and the other te-te-te-te somewhat lower in pitch and louder.

Nesting. The breeding habits of Pycrofts Petrel on Hen Island have been investigated by C. A. Fleming from whose paper the following information is taken: The birds come ashore during the third week in November. Burrows are found in all parts of the island where there is soft soil, mostly on the lower slopes. Most of the burrows are short, about an arm's reach in length. Some are up to five or six feet in length. The nesting chamber is usually about fifteen inches in diameter and contains a well-built nest of dead leaves and grass. Laying begins in the last week in November. By December 8th most eggs showed signs of incubation. The date of hatching was not ascertained but by the end of January all "should have hatched."

References.—Falla, Rec. Auck. Mus., 1, 176, 1933 (*Pterodroma pycrofti,* Hen Island); 1, 257, 1934. Mathews, Suppl. Birds Norf. Lord Howe Is., 86, 1936. Buddle, Emu, 41, 62, 1941. Fleming, Emu, 41, 69, 1941. Falla, Emu, 42, 114, 1942.

Gould Petrel

Pterodroma leucoptera

The Gould Petrel was first described by John Gould in 1844 from specimens taken on Cabbage Tree Island off the coast of New South Wales, where it still breeds. In April 1942 P. C. Bull, R. B. Sibson and E. G. Turbott found the remains of ten birds on the Muriwai beach west of Auckland. This was the first recognition of the species in New Zealand. Nearly four years afterwards another specimen was picked up in the same locality.

Adult. Forehead freckled black and white, the feathers being black with a white border. Top of head with a narrow band encircling the eye, hind neck and upper back sooty black. Back and upper tail coverts grey, the feathers with subterminal black band and white tip; rump sooty black; tail grey, central feathers tipped sooty, outer feathers with white inner webs grey towards the tips. Primaries brownish black with triangular area of white on the inner webs; secondaries grey with inner webs largely white; lesser and secondary coverts brownish black; greater coverts grey edged with white. Lores and under surface white. Bill black. Iris brown. Feet light greyish blue, outer toe and joints of other toes brown, webs slaty grey, dark distally, claws dark brown. Bill, males 25.1, females 23.5, males and females wing 224.7, tail 93.8, tarsus 29.2, mid toe 37.4 mm. (av. mmts. Hindwood and Serventy). Cabbage Tree Island. *Nestling* covered with dark grey down, with narrow area of whitish on the under surface.

Eggs. Clutch one, oval, chalky white, 49.8 x 37.8 mm. (av. 10 eggs).

Status. In its dark upper surface, white tips to the wing- and upper tail-coverts and feathers of the back, and the blue and brown feet this species differs from all other New Zealand species. Its nearest relatives are *longirostris* of Japan and *masafuerae* of the Juan Fernandez group. The former is probably identical with, the latter subspecifically distinct from, *leucoptera.* Attempts have been made to associate this species, as a subspecies, with other allied forms, but in view of our lack of knowledge of the breeding areas and the forms inhabiting them such attempts seem premature. The New Zealand specimen found in 1946 agrees closely with the typical form from Cabbage Tree Island, New South Wales. The ten found in 1942 are listed in the *Checklist* as *Pterodroma leucoptera subsp.*, being distinguished by P. C. Bull from the typical race.

Distribution. Muriwai beach, west of Auckland, all cast up on beach.

South-eastern coast of Australia and Tasmania, breeding on Cabbage Tree Island. Birds referred to this species have been taken north-west of the Kermadec Islands and on Efate Island, New Hebrides.

Food. Stomach contents have revealed only one kind of food—cephalopods—eaten by this petrel.

Nesting. The breeding habits of this species on Cabbage Tree Island have been described by Hindwood and Serventy who state that it nests among heaps of boulders giving natural cavities and shelters with abundant top cover. It does not excavate a burrow in soil. The nest is a slight depression within the natural cavity and is lined with a small quantity of dead palm leaves on which the single egg is laid. The birds arrive about October and lay in late November and early December. Young have been found in January. By the middle of March practically all the birds have left the island.

References.—Gould, Ann. Mag. Nat. Hist., 13, 364, 1844 (*Procellaria leucoptera,* Cabbage Tree Island). Godman, Monogr. Petrels, 243, col. pl., 1909. Hull, Emu, 10, 252, 1911. Murphy, Amer. Mus. Nov., no. 370, 8, 1929. Hindwood and Serventy, Emu, 41, 1, 1941. Falla, Emu, 42, 114, 1942. Bull, Emu, 42, 145, 1943; N.Z. Bird Notes, 2, 29, 1946.

Cooks Petrel. Titi

Pterodroma cooki cooki

During Cook's first voyage specimens probably of this petrel were shot off the East Cape (October, 1769) and off the West Coast of the North Island (January, 1770). It was next collected by Dieffenbach about

1840 in New Zealand, and was described by Gray in the second volume of Dieffenbach's *Travels*. Its breeding places were discovered by Reischek on Little Barrier Island in 1882, and by Stead on Codfish Island, off Stewart Island, in 1935.

Adult. Upper surface grey, the feathers with pale margins; a blackish brown patch on the rump; wings brownish black; central tail feathers grey with blackish brown tips, lateral tail feathers generally white speckled with grey; forehead white, freckled with grey; a white line over the eye; space round eye dark. Under surface white; under surface of wings white with a narrow broken border of brown and grey, inner webs of quills white to near the tip. Bill black. Iris dark brown. Feet purplish blue, webs dark yellowish, the terminal portion of webs and toes black. Bill 25.5-29, wing 227-240, tail 88-95, tarsus 27.5-36, mid toe 37-41 mm. *Immature* similar to adult but general colour paler and white edgings to the feathers more pronounced. *Nestling*, second down pale grey above white below.

Eggs. Clutch one, elliptic, white, 51 x 40.4, 51.2 x 36.2, 50.8 x 38, 54.5 x 39.6 mm. Codfish Island. 53 x 38.5 mm. Little Barrier Island.

Status. Cooks Petrel stands apart from the other small species of *Pterodroma* by reason of its long bill, 26-30 mm. A near relative is *P. pycrofti* which differs in its shorter bill and wings and in its slightly longer tail. In colour *cooki* and *pycrofti* are similar, *pycrofti* being slightly darker. *P. leucoptera* has blue feet and a short bill but the upper surface is darker than in *P. cooki*. Cooks Petrel consists of two subspecies, *P. c. cooki* in New Zealand, described above, and *P. c. defilippiana* in the eastern South Pacific, distinguished by the greater depth of the bill and the longer tail.

Distribution. New Zealand seas from the Kermadecs to the Bounty Islands, most plentiful off the east coast of the North Auckland Peninsula and around Stewart Island. Breeds on Little Barrier Island and Codfish Island. Elsewhere it has been observed or collected at Mokohinau, Chicken Islands, Great Barrier Island, Muriwai (west coast of Auckland), Titirangi, Bay of Plenty, Lyall Bay, Cape Campbell and Puysegur Point. In winter this subspecies migrates to the northern and eastern Pacific.

Ecology. The Cooks Petrel's breeding stations in the west Pacific lie within the subtropical belt of ocean waters, the Codfish Island locality touching the subantarctic zone. In New Zealand the birds are not seen in coastal waters from May to September inclusive.

When Reischek visited Little Barrier Island between 1882 and 1885 he found Cooks Petrel "every year decreasing." In his last trip he did not see this petrel at all but of other kinds there were "plenty of remains such as wings, feathers, etc., destroyed by wild cats, native dogs, and wild pigs." The dogs and pigs have since gone but cats are plentiful. The petrels are an easy prey as they go to and come from their burrows. With this, in summer, unlimited supply of food, the cats have come to be fastidious, and after eating the brain and the breast, leave the carcase to kill another bird. Unless the cats can be checked it is possible that this species will be exterminated on Little Barrier Island.

Food. Only cephalopod beaks have been found in the stomachs of Cooks Petrel indicating that squids are the usual food of this, as they are of many other kinds of petrels.

Little Barrier Island *B. Sladden*
COOKS PETREL

Voice. The usual cry of birds on the wing is a rapidly repeated note which has been rendered ti-ti-ti or whik-kek-kek-kek. Sibson, observing the birds on Little Barrier Island, writes as follows: "Cooks petrel has many distinct calls. Perhaps the most frequently used are the quick 'whi-kek-kek' and the goat-like bleating. There are also a slow, deliberate 'kek-kek-e' and a less seldom heard 'hwit-wit.' Last year's puzzling 'borrr' definitely comes from *cooki;* and there is also a cat-like 'purrp.'"

Nesting. Everywhere on the hillsides and ridges of Little Barrier Island from about midway between the sea coast and the summit, to the summit which is 2,500 feet above sea level, the burrows of Cooks Petrel are to be found. According to Reischek who camped among these birds, the burrows are from four to six inches in diameter at the entrance and very long, being from four up to twelve feet in length. They wind about roots and stones and terminate in two chambers in each of which is a hollow lined with leaves and grass. The birds arrive in October to clean out the burrows. The single egg is laid in early November and the young is ready to fly in March. Both parents assist in preparing the burrows but only the female was found sitting, the male being found close by in a burrow by himself. When the young are hatched, both the male and the female feed them.

The other breeding place so far known, namely, Codfish Island, in Foveaux Strait, was discovered and investigated by E. F. Stead. Here Cooks Petrel was nesting in great numbers. "The state of the eggs indicated that laying had commenced here about December 12th, which is some weeks later than is the case on Little Barrier. The birds were plentiful on Codfish Island, their burrows being everywhere from 15 feet above sea level up to the tops of the bush. The shortest burrow we found was about four feet, while the longest we dug out was 12 feet, . . . The average length was probably about seven feet. On Codfish Island a rough estimate indicated that there were over twenty thousand burrows."

Maori. Formerly the Maoris collected the young titi for food and esteemed the flesh of this species above that of other sea birds. Long distances were traversed to the breeding grounds which were carefully preserved. A method commonly used by the Maoris for taking titi was to light fires to attract them when on their way to their breeding places and to spread nets on the hilltops in the line of flight.

References.—Gray, Dieff., Travels N.Z., 2, 199, 1843 (*Procellaria cookii,* New Zealand). Buller, Birds N.Z., 307, 1873; 2nd ed., 2, 217, 1888. Reischek, Trans. N.Z. Inst., 18, 92, 1886. Godman, Monogr. Petrels, 247, col. pl., 1909. Murphy, Amer. Mus., Nov. No. 370, 1929. Falla, Rec. Auck. Mus., 1, 257, 1934; Emu, 42, 115, 1942. Stead Trans. Roy. Soc. N.Z., 66, 315, 1936. Fleming, Emu, 41, 69, 1941. Sibson, N.Z. Bird Notes, 2, 137, 1947.

Mottled Petrel. Rainbird. Korure

Pterodroma inexpectata

The Mottled Petrel was discovered in the South Pacific Ocean during Cook's second voyage. A painting was made by George Forster and a description drawn up by his father J. R. Forster. This description was not published until 1844 when Forster's manuscript was edited by Lichtenstein. Subsequently the Mottled Petrel has been collected in various parts of the Pacific and has received a number of names. In 1872 a specimen was shot on the Potts River, Canterbury, and to this Buller gave a new name (*affinis*). Its breeding place was discovered at Preservation Inlet by Percy Seymour in 1891, and at the Chatham and Bounty Islands by the Whitney South Seas Expedition in 1926.

Adult. Upper surface dark ashy grey; the feathers of the head, back, scapulars and short upper tail coverts blackish brown; marginal wing coverts, primary coverts, and primaries brownish black; the secondaries and their coverts ashy grey margined with white; tail ashy grey. Forehead and sides of face white mottled with black; lores, chin and throat white; a patch of greyish black under each eye. Upper breast freckled brown and white; lower breast and abdomen brownish grey; under tail coverts white; under surface of wings white with broad grey margins; inner webs of primaries white. Bill black. Iris dark brown. Feet yellowish, the distal part of the webs and toes black. Bill 26-28, wing 247-259, tail 96-104, tarsus 30.7-35, mid toe 41.2-47 mm (14 skins). Preservation Inlet. *Immature.* Differs from the adult in being generally darker in plumage. *Nestling.* Covered with sooty grey down.

Eggs. Clutch one, almost elliptical being very slightly tapered at one end, smooth, white, 59.6 x 43.4, 61 x 42.6, 62.8 x 43 mm. Solomon Island off Stewart Island.

Status. Probably the nearest ally is *P. mollis* of the South Atlantic and South Indian Oceans. It also has some resemblance to the *cooki* group, but it differs from both in the brownish grey abdomen.

Distribution. Formerly breeding plentifully in the central mountain ranges of the North Island, Kaimanawa, Ruahine and Ruapehu, and throughout the whole of the South Island including Banks Peninsula. Probably it still breeds in some inland localities, but there are no recent reports of its breeding on the mainland except at Preservation Inlet. It still breeds on Cuvier Island, Stewart Island and offlying islets, and the Snares. Present at the Chatham, Auckland, Antipodes and Bounty Islands and probably breeding on some of them. Birds have been picked up in many localities, for example, Dargaville, Awhitu, Muriwai, Tiri, Red Mercury Island, Mt. Maunganui, Taupo, Rangitikei beach, Kapiti Island, Cape Campbell, New Brighton, Spencer Mountains, Potts River, Arthur Pass, Moeraki and Puysegur Point. Stead says that he has heard this species in the Malvern Hills, at Lake Coleridge, Waiau River and the hills behind Timaru.

The South Pacific Ocean from 35° South latitude to the Antarctic Sea; in the southern winter ranging to the North Pacific as far as the Aleutian Islands and Alaska. A specimen has been obtained from Circular Head, Tasmania.

E. F. Stead

MOTTLED PETREL

Voice. All observers have reported the usual call of the Mottled Petrel as a high pitched te-te-te-te rapidly and continuously repeated, when the bird is in flight. It has another quite different call which Stead refers to as a deep resonant bugle note of two syllables "goo-oo." Richdale likens this to the foghorn of a steamer.

Nesting. The breeding habits of the Mottled Petrel on the islands off Stewart Island have been well described by E. F. Stead. What follows is taken from his account. By November 20th most of the birds were cleaning out their burrows and at this time two birds often stayed in the burrow all day. They come ashore late at night and leave early in the morning. The burrows are mostly between two and a half and three feet in length. Some are much longer. In a steep bank the burrow usually turns sharply to right or left. The nest is placed in an enlarged chamber and is often well made, a quantity of fine grass and small leaves being used to make a deep cup-shaped structure covering the floor of the nest chamber. Sometimes only a few twigs or leaves constitute the nest. When the burrow is finished both birds stay in it for some days, then the female is left alone until she lays her egg. Sometimes both birds are found with the egg and sometimes both birds leave the burrow for a day or so after the nest is completed and before the egg is laid. Eggs were found during the first half of December. On the Snares the young are able to fly by the first week in May.

Maori. Formerly the korure was taken in large numbers in inland breeding places in the North Island.

References.—Forster, Desc. Anim., 204, 1844 (*Procellaria inexpectata,* Antarctic Ocean). Buller, Trans. N.Z. Inst., 7, 216, 1875 (*P. affinis,* Potts R.); Birds N.Z. 2nd ed., 2, 223, col. pl., 1888; Suppl., 1, 117, 1905. Godman, Monogr. Petrels, 236, 239, 241, 1908 (*O. gularis,* col. pl., *O. fisheri O. scalaris*). Loomis, Proc. Cal. Ac. Sci., (4) 2, 104, 1918. Stead, Life Hist. N.Z. Birds, 72, 1932.

Christmas Island Petrel

Pterodroma alba

The specimen on which Latham founded his White-breasted Petrel probably was collected on Christmas Island during Cook's third voyage. Gmelin associated the scientific name *Procellaria alba* with Latham's description. The inclusion of the species in the New Zealand fauna is based on a specimen collected by W. S. Bell on Raoul Island on March 7th, 1913, and described by Mathews and Iredale under the name *Aestrelata oliveri.*

Adult. Bluish black, the lower breast and abdomen white; a white patch on the throat; wing lining white. Bill black. Iris dark brown. Feet pinkish, the distal portion of the webs and toes black. Bill 28, wing 277, tail 115, tarsus 34 mm. Raoul Island.

Status. The Kermadec bird agrees with this species except that, according to Mathews and Iredale, it is bluish black instead of brownish black and it has white on the under surface of the wings. Possibly it was a young bird and as such might show a more blue appearance than the adult. Subspecies of which *P. a. oliveri* is one have been defined but none has been clearly differentiated from the typical *alba* of Christmas Island.

Distribution. Raoul Island. Four birds were seen on the ground in the forest on 7th March, 1913. Presumably the species breeds on the island.

The tropical and subtropical Pacific from the Kermadec Islands eastward to the Marquesas. It is known to breed in the Phoenix, Tonga, Tuamotu, and Marquesas Groups, and on Christmas, Oeno and Ducie Islands.

Nesting. Like the Kermadec Petrel this is a surface breeding bird. On Christmas Island the nests are merely holes scooped out of the ground under low bushes. The birds are such close sitters that nothing will induce them to leave their eggs, and if removed from their nests instantly return to them.

References.—Gmelin, Syst. Nat. 565, 1789 (*Procellaria alba,* Christmas Id.) Peale, U.S. Expl. Exped., Birds, 8, 298, 1848 (*Procellaria parvirostris,* Pukapuka). Godman, Monogr. Petrels, 193, 1900. Mathews and Iredale, Austr. Av. Rec. 2, 113, 1914 (*Aestrelata oliveri,* Kermadec Is.).

Kermadec Petrel

Pterodroma neglecta neglecta

The Kermadec Petrel was first collected by Macgillivray, naturalist to the *Herald,* which visited Raoul or Sunday Island in 1854. It was, however, not described until 1863 when Schlegel named it *Procellaria neglecta.* From the date of Cheeseman's visit to the Kermadecs in 1887, numerous specimens have been received from Raoul Island and, on account of the variability of the species, several names have been bestowed on it.

Adult. It would be impossible to include in one definition the numerous colour variations of this polymorphic species. The following description is taken from a bird of average intermediate coloration. Fore part of crown mottled brown and white; top of head and back and sides of neck brown, the feathers having whitish margins; remainder of upper surface dark brown, the long scapulars, primaries, upper tail coverts and tail blackish. Forehead, lores, sides of face, line over eye, and under surface white; under tail coverts white freckled with brown; inner

Meyer Island *W. R. B. Oliver*
KERMADEC PETREL

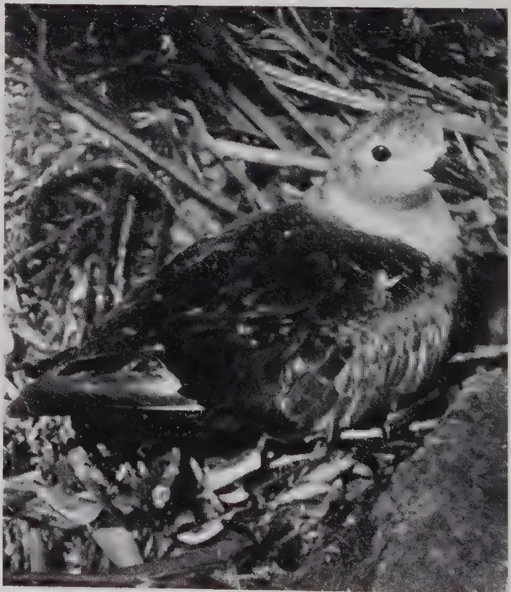
webs of primaries white for more than half their length. Bill black. Iris dark brown. Feet whitish, the terminal portion of the webs and toes black. Bill 28.8-32.5, wing 281-303, tail 100-107, tarsus 35-38.8, mid toe 49-55.7 mm. In the usual white headed form the head, neck and the whole of the undersurface are pure white, except that there are brown freckles on the forehead and crown. The remainder of the upper surface is pale ashy brown, primaries darker. Bill black. Feet whitish, the distal portion of the webs and toes black. In the darkest coloured birds the upper surface is sooty black, the feathers of the forehead with lighter margins. Under surface greyish brown. Bill and feet black.

Immature. More uniformly and darker coloured than the adults. Although adult birds with white heads were frequently seen on Raoul Island no young birds had more white on the head than a few whitish or grey feathers on the crown. In an adult pair I carefully noted one bird was brown above, including the head, and white below, the other was brown above with the whole of the head, neck and under surface, except freckling on the crown, white. Thus a light and an intermediate bird were mated. The young was of a uniform dark slaty-black colour. *Nestling.* Covered with long down varying from light to dark grey. *Colour varieties.* Two albinos from Raoul Island are in the Auckland Museum.

Eggs. Clutch one, ovoid to broadly ovoid, white, 64 x 46, 67 x 45.5 mm. Raoul Island; 65 x 47, 70 x 49 mm. Meyer Island.

Polymorphism. The Kermadec Petrel may be considered as consisting of a light phase, a dark phase and innumerable intermediates, though this is probably too simple an explanation.

The characters may be distributed in various combinations though as a general rule certain groups of characters go together. Thus dark birds usually have black feet, light birds whitish feet, and birds of intermediate plumage bluish feet. This rule, however, is not invariable for a few dark birds with light feet and a few light-coloured birds with dark feet were noticed showing that the characters are inherited independently, and those usually associated may become separated. The variable characters are the colours of the head and neck, except the forehead which is almost always freckled; the breast and abdomen which may be any shade between white and dark brown; and the feet which vary from whitish through bluish to black.



Raoul Island *R. S. Bell*
KERMADEC PETREL

A single specimen only with a pure white head was noticed during the ten months I was on Raoul Island.

Between the extremes every shade exists. As varieties cannot be defined it is practically impossible to estimate the incidence of the colours. When collecting young birds for food I roughly classified 549 specimens into four groups according to the colour of the underparts. The result was as follows:—

	No. of birds	Per cent.
Under surface blackish	101	18.4
,, ,, grey ...	215	39.2
,, ,, greyish	183	33.3
,, ,, white	50	9.1

Iredale made a similar estimate with 264 adult birds obtaining the following results:—

	No. of birds	Per cent.
Under surface black ...	34	13
,, ,, dark ...	64	24
,, ,, white	166	63

This would indicate that the colour of the under surface is lighter in the adult than it is in the immature bird. This accords with other observations. It was constantly noticed that the young were darker than their parents. Iredale's list included 34 black-headed birds (13 per cent.), 128 birds of intermediate shade (49 per cent.), and 102 light-headed birds (38 per cent).

Status. Two subspecies are recognised, one, *P. n. neglecta,* of smaller size and the other, *P. n. juana* larger. The constant features of the Kermadec Petrel are the size, dark brown upper surface with blackish wings and tail, the freckling on the forehead and the white on the inner webs of the primaries. This combination of characters will serve to distinguish it from the other species of Pterodroma found in the New Zealand region. Its nearest ally is *P. arminjoniana* of the eastern Pacific and South Atlantic oceans.

It may be that a distinct form of the Kermadec Petrel is being evolved on Meyer Island. Here the birds have a different breeding season, the voice has lost some of its pecularities, for instance the terminal "coo" is seldom heard, and the coloration seems to be more uniform, that is to say, although the extremes of colour are the same as on Raoul Island the dark and light phases appear to be less frequent. I noticed an intermediate and a light-coloured bird paired.

Meyer Island *W. R. B. Oliver*

KERMADEC PETREL CHICK

Distribution. Breeds on Raoul and Meyer Islands in the Kermadec Group during the summer and the winter. Two specimens picked up at Muriwai Beach, west coast of Auckland.

The South Pacific Ocean north of 40° South latitude, ranging into the tropics. Breeds at Lord Howe Island, Tuamotu Archipelago, Ducie Island, Oeno and Tubuai Islands. Straggler to east coast of Australia.

P. n. juana breeds in the Juan Fernandez and San Ambrosio groups in the eastern South Pacific.

Ecology. The Kermadec Petrel is found in the subtropical belt of the South Pacific ranging into the tropics in the eastern Pacific. The summer breeding form remains at sea from May to August and the winter breeding form from September to December.

According to information gained by officers of the Lands and Survey Department on Raoul Island in 1937 the birds were not nearly so numerous as they were ten years before. So many dead birds were seen that the impression was received that the species was in danger of being exterminated there. Being surface breeders these petrels are easily taken by cats which generally eat only the breast.

Food. Judging from the contents of the stomachs of young birds, the food of the Kermadec Petrel consists mainly of crustacea and cephalopods.

Voice. The Kermadec Petrel utters its call when flying and is especially noticeable in the evening when thousands may be seen circling overhead. The cry may be described as a long drawn-out "ow" in a descending pitch followed by "coo" repeated several times. The winter breeding form has a similar cry but seldom finishes with the "coo" sound.

Nesting. The observations which I took during a ten months' stay on Raoul Island were later supplemented by those taken by R. S. Bell during three subsequent seasons so that a fairly full record was obtained. The birds are first seen flying out at sea early in August. Each evening they appear to come nearer the island and by the 22nd a few were found on the ground. They breed on the surface, scratching a shallow hollow. This operation was actually observed by Bell who states that he saw a bird go under a log, fluff out its feathers, stand up and then lean forwards on its breast and scratch the earth backwards with both feet at once. In half an hour's time a hollow about eight inches across and two inches deep was made. The birds then collect sticks and leaves and make a nest. This completed, they leave the island for two or three weeks and then return to lay.

Eggs are plentiful in the beginning of November. Fresh eggs have been noticed as early as October 20th and as late as December 6th. The period of incubation is 50 to 52 days. The first young ones are to be seen about the middle of December. They are plentiful after December 20th, and most will be hatched by the end of January. They remain in the nest where they are fed by the parents for over three months, during which time they become very fat. Towards the end of May, the adult birds leave Raoul Island and the young are left to find their own way to sea.

After the parents cease to feed them, the young gradually get thinner, and in ten days or a fortnight's time walk away from their nest, climb up on to a stone or tree trunk and take their first flight. This is rather an unsteady one straight out to sea. Most of the young fly in April and May but a few late ones may be seen during the first week in June.

On Meyer Island the Kermadec Petrel breeds during quite a different season being about four months later than on Raoul Island. Thus the eggs are laid at the end of February and during March and the first half of April. The young birds are hatched from the last week in April onwards and leave the island in July and August.

Uses. The Kermadec Petrel, or Mutton Bird as it has been called by the settlers of Raoul Island, has always formed the staple food of the inhabitants. The method of preserving is as follows. The young birds are collected at the end of March. After killing, plucking and cleaning they are opened out and dry salt rubbed well in. The following day they are transferred to brine and next day put in a smoke-house. Here they remain for a day and are then ready for storing. This is done by pressing them down in casks until their own oil covers them. In this condition they will keep for two or three years.

References.—Schlegel, Mus. Pays. Bas., 6, 10, 1863 (*Procellaria neglecta,* Kermadec Is.). Godman, Monogr. Petrels, 226, col. pl., 1908. Hutton, Proc. Zool. Soc., 1893, p. 752 (*Oestrelata leucophrys, O. neglecta, O. phillipi*). Buller, Suppl. Birds N.Z., 1, pp. 112, 115, 119, 1905 (*O. mollis, O. neglecta O. phillipi*). Iredale, Emu, 10, 13, 1910; Ibis, 1914, 423. Loomis, Proc. Cal. Acad. Sci. (4) 2, 102, 1918. Murphy, Ocean. Birds S. Amer., 2, 704, 1936; Am. Mus. Nov. no. 1580, 25, 1952.

Black-capped Petrel

Pterodroma externa cervicalis

The Black-capped Petrel was first procured in the Kermadec group by Captain Carpenter of the whaling barque *Costa Rica Packet.* A specimen was presented by him to the British Museum and was described by Salvin in 1891; the same year, several others were collected on Raoul Island by T. Bell.

Adult. Crown of head and below the eye brownish black; forehead white, the hinder portion mottled with black; hind neck and sides of neck white mottled with dusky grey; upper back grey; lower back and wings brownish black; upper tail coverts slaty grey; central tail feathers slaty black, the lateral ones slaty grey, white on the inner webs, the two outermost mostly white. Under surface white, except the front border of the wing lining which is mottled black and white. Bill black. Feet flesh colour, terminal portion of webs and toes black. Bill 36-38, wing 308-320, tail 127-138, tarsus 37-41, mid toe 49-54 mm. (8 skins). *Immature.* Like the adult but lighter, the feathers of back and the upper wing coverts margined with grey. *Nestling.* Covered with dove-grey down, the abdomen and a central line on the throat and breast white.

Eggs. Clutch one, broadly ovoid, white, 68 x 48, 64 x 47, 64.5 x 45 mm. Raoul Island.

Status. This handsome petrel is quite distinct from all others found in New Zealand by virtue of its black cap and white collar. Two rather distinct subspecies constitute this species. *P. e. externa* differs from *P. e. cervicalis* in the absence of a white collar, in the entirely white under surface of the wing, and in the crown and upper surface being lighter in colour.

Distribution. Known only from the Kermadec group where it breeds on Raoul Island.

P. e. externa. Eastern South Pacific Ocean moving into the tropics in the non-breeding period. Breeding on Mas a Fuera of the Juan Fernandez group.

Raoul Island *W. R. B. Oliver*

BLACK-WINGED AND BLACK-CAPPED PETREL CHICKS

Nesting. The Black-capped Petrels breed in small communities on the upper slopes of Raoul Island. In one locality they were found nesting in association with the Wedge-tailed Shearwater. They make burrows in which they remain during the day but come out at night, when their distinctive cry is heard. They arrive at Raoul Island in October. Towards the end of the month their peculiar cry can be heard. During November they scratch out the burrows in preparation for laying which commences towards the end of December, fresh eggs having been taken from December 26th to January 2nd. Young in down have been taken from their burrows at the end of March and in mid-April. The young become fledged during May and leave the island in June, some as late as the end of the month.

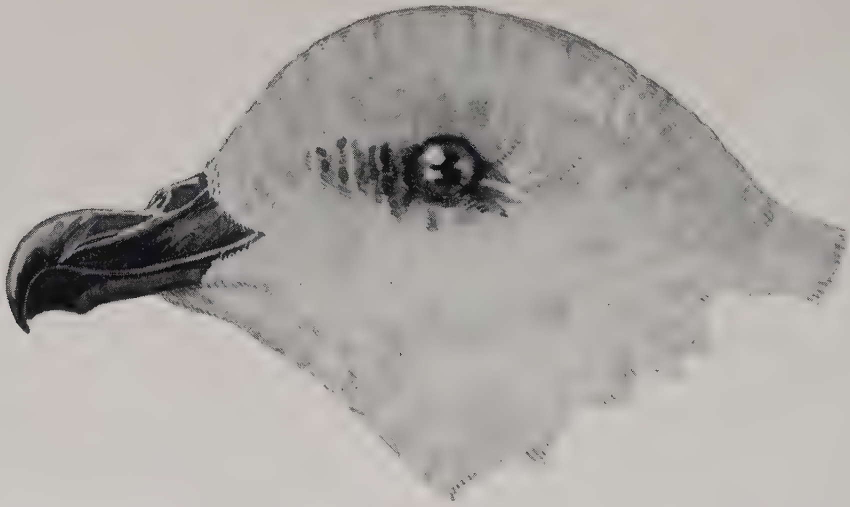
References.—Salvin, Ibis, 1875, 373 (*Oestrelata externa,* Mas a Fuera), Salvin, Ibis, 1891, 192 (*O. cervicalis,* Raoul Island). Salvin, Cat. Birds. Br. Mus., 25, 411, col. pl., 1896. Loomis, Proc. Cal. Ac. Sci., (4), 2, 55, 1918. Buller, Suppl. Birds N.Z., 1, 114, col. pl., 1905. Godman, Monogr. Petrels, 223, col. pl., 1908.

White-headed Petrel

Pterodroma lessoni

The White-headed Petrel was collected during Cook's first voyage to the eastward of the Kermadecs and later in Bass Strait. The first published description of it, however, was that by Garnot in 1826, his specimen being obtained at Cape Horn. It was collected in the New Zealand seas during the voyage of the *Astrolabe* and *Zelee* in 1839, and next appears to have been observed north of the Great Barrier Island by Hutton in 1866.

Adult. Upper surface from the hind neck pale grey, darker on the lower back, feathers of the upper back edged with white; wings brownish black. Head and under surface white; a black space round the eye. Bill black. Iris dark brown. Feet pink, the outer portion of the web and toes and the outer side of the outer toe black. Bill 34.5-40, wing 296-313, tail 130-140, tarsus 40-46,



E. H. Atkinson

WHITE-HEADED PETREL

mid toe 60-65 mm. *Nestling* covered with long slaty-grey down, whitish on the throat. Antipodes Island.

Eggs. Ovoid, white, 73 x 52.5 mm. Antipodes Island. 71 x 51.5 mm. Macquarie Island.

Status. The White-headed Petrel has a counterpart in *Pterodroma incerta,* breeding at Tristan da Cunha, which is a brown bird and breeds in a warmer oceanic area.

Distribution. Abundant to the south of New Zealand, less commonly met with to the northward. Breeds at the Auckland, Antipodes and Macquarie Islands. In New Zealand it has been observed or obtained at Bay of Islands, Maunganui Bluff, Kaipara, Muriwai, north of Great Barrier Island, Hen and Chickens, Papaiti (Wanganui River), Kapiti Island, Pukerua Bay, New Brighton, Paroa (Westland), Chatham Islands and other places.

Indian and Pacific Oceans from 30° South latitude to the Antarctic continent. Breeding on Kerguelen.

Nesting. Very little is known about the life history of the White-headed Petrel. The specimens found on the New Zealand coast are picked up mainly in the winter months May to July, but odd ones are found all the year round. Eggs have been found on Macquarie Island in mid December and on Antipodes Island a month later. At the Auckland Islands nearly all the eggs are hatched at the end of January. At Antipodes Island a young bird in down was seen on April 4th.

At the Auckland Islands, E. F. Stead found the White-headed Petrel breeding and kindly provided me with the following notes relating thereto, the date being February 2nd. "It was not until I had examined a great many burrows that I got a nest with an egg in it. This egg was addled, and in another nest close by, I found another with the chick just hatching. There were numbers of burrows in some hummocky country covered with tussock and small scrub, but all we examined had young birds in them. As many of these young were apparently only a few days old, and as I found only one that had its parent with it in the burrow, it is evident that the old birds leave the young alone in the burrows very soon after they are hatched. The nests were bulky structures of grass, and the burrows, which were about four feet long, had their inner half more or less paved with grass, both nest and paving being freely sprinkled with feathers. Indeed there were so many feathers in some of the nests that it looked as though the bird must have plucked itself after the manner of a duck."

References.—Garnot, Ann. Sci. Nat., 7, 54, 1826 (*Procellaria lessoni,* Cape Horn). Buller, Birds N.Z., 303, col. pl., 1873; 2nd ed., 2, 219, 1888. Godman, Monogr. Petrels, 181, col. pl., 1907. Murphy, Am. Mus. Nov., no. 1580, 17, 1952. Falla, B.A.N.Z.A.R.E., 182, 1937.

Bird of Providence

Pterodroma solandri

Bird of Providence was the name given to this petrel by the inhabitants of Norfolk Island in the last decade of the eighteenth century when they ran out of supplies because bad weather prevented ships from visiting the island regularly. Had it not been for this bird they would have faced death from starvation. From April to July 1790 more than 170,000 were taken and each year large numbers were destroyed until the species was exterminated on that island. The Bird of Providence is included in the New Zealand list on the evidence of a single mutilated specimen found washed on the beach at Muriwai, west of Auckland, by R. A. Falla in January, 1921.

Adult. General colour above slaty black, the feathers of the back, rump and upper tail coverts broadly margined with darker; crown of head brown. each feather with a subterminal grey band; forehead, lores and cheeks brown mottled with white, the feathers being brown with broad white margins; wing coverts brown margined with lighter; primaries black with white wedge on the basal half of the inner webs; tail slaty brown, the feathers with white bases, narrow edge and tips; outer tail feathers dark slate, with basal half of inner web and narrow margin white. Throat slaty grey mottled with white; under surface ashy brown, darker on neck and abdomen; lower neck feathers brown broadly margined with paler; bases of all the body feathers white; under wing coverts slate, bases and margins of feathers white. Bill black. Feet dark grey. Bill 35, wing 295, tail 138, tarsus 43, mid toe 62 mm.

Eggs. Clutch one, oval, some more pointed than others, dull white, with shallow irregular pittings. 66 x 48, 64.7 x 47.5, 62 x 48 mm. Lord Howe Island.

Distribution. Muriwai Beach, one occurrence.

Lord Howe Island, breeding. Formerly breeding in large numbers on Norfolk Island, now extinct there.

Habits. The Bird of Providence breeds on the upper slopes and summit of Mount Gower, 2840 feet, and Mount Lidgbird, Lord Howe Island. When I visited Lord Howe Island in November 1913 it was breeding on Little Slope at sea level under Gower but I learn from Hindwood's article that it is not now breeding in that locality. It breeds during the winter months arriving in March. Eggs are laid during June and July, and young birds have been found in the burrows in October. They leave the island in October and November. The burrows, according to H. Wilson, are mostly made in rocky places where cutting-grass is growing and the ground wet. They are sometimes six feet in length. Nests are also found under rocks in inaccessible positions. The nests are large accumulations of cutting-grass leaves in which the egg is almost concealed. All the burrows examined had two outlets.

References.—Gould, Ann. Mag. Nat. Hist., 13, 363, 1844 (*Procellaria solandri,* Bass Strait). Godman, Monogr. Petrels, 219, 1908. Hull, Proc. Linn. Soc. N.S.W., 35, 783, 1911 (*Oestrelata montana,* Lord Howe Island). Mathews, Birds Norfolk and Lord Howe Is., 17, 1928. Whitley, Austr. Zool., 8, 42, 1934. Hindwood, Emu, 40, 41, 1940. Murphy, Am. Mus. Nov., no. 1580, 15, 1952.

Kerguelen Petrel

Pterodroma lugens

The Kerguelen Petrel was collected during Cook's second voyage in the South Atantic Ocean. The specimen, now lost, was described and figured by Kuhl and Banks' name *Procellaria lugens,* quoted by Kuhl in synonymy, is accepted as the first naming of the species. Lesson's name *brevirostris* has generally been applied to the Kerguelen petrel, but according to Pucheran *brevirostris* had yellow feet whereas the Kerguelen petrel has purplish grey feet. Two specimens reached the Dominion Museum on the same day in July 1934. Possibly a small flock was in New Zealand waters at that time. One specimen found at Ohakea was almost fresh. It was picked up on July 16th by Mr. H. A. Fraser. The other specimen was found on Kapiti Island in a much mutilated condition by the caretaker of that bird sanctuary, Mr. A. S. Wilkinson.

Adult. Above dark slaty-grey, the feathers with paler margins; upper tail coverts slaty-grey with pale margins; tail slaty black; wings greyish black with slaty grey margins to the feathers, quills black, the inner webs brown edged with grey. Around the eyes greyish black. Under surface brownish-grey changing to slaty-grey on the under tail coverts; axillaries slaty-grey with paler margins; under wing coverts slaty-grey with whitish margins; under surface of outer quill grey with a well defined whitish band along the shaft. Bill black. Feet brownish-grey with purplish sheen, claws black. Bill 26.5, wing 255, tail 108, tarsus 38, mid toe 49 mm. Ohakea. *Nestling* clothed in sooty brown down. Kerguelen.

Status. The slaty plumage, compressed bill and the sharply ridged nasal tubes distinguish this species.

Distribution. Six occurrences. Ohakea, Otaki, Kapiti Island, Karori, Paekakariki, Christchurch.

South Atlantic and Indian Oceans, breeding on Tristan da Cunha and Kerguelen. A straggler to Western Australia.

Nestling. Very little has been recorded about the breeding habits of the Kerguelen Petrel. Robert Hall on January 25th found a burrow which branched at the end of a long tunnel. One end contained a Cape Hen, the other a Kerguelen Petrel, both without eggs. A. E. Eaton found a Cape Hen's egg in the chamber of the main burrow and a nestling of what he thought was a Kerguelen Petrel in a branch burrow. This was in January, and a nest containing a partly incubated egg was found on November 8th. He states that the nest was two or three inches in height and composed of damp and decayed vegetable matter comprising sprigs of *Acaena* and *Azorella* and tufts of *Festuca erecta.*

References.—Kuhl, Beit. Zool. Vergl. Anat. 144, 1820 (*Procellaria lugens,* Atlantic Ocean). Coues, Bull, U.S. Nat. Mus., 2, 28, 1875 (*Oestrelata kidderi,* Kerguelen). Mathews, Birds Norfolk and Lord Howe Is., 102, col. pl., 1928. Campbell, Emu, 26, 153, col. pl., 1927. Oliver, Emu, 34, 158, 1935. Grant and Mackworth-Praed, Bull. B.O.C., 74, 71, 1954.

Grey-faced Petrel. Oi

Pterodroma macroptera gouldi

During Cook's first voyage a black petrel with black feet, probably this species, was obtained off the north coast of New Zealand. It was taken in the Cape seas in 1840 and described under its present name. In 1870 Hutton obtained a specimen near Auckland and considering it to differ from the Cape species gave it a new name. Its breeding place was first discovered by Mr. T. Kirk on a small island near Kawau.

Adult. Sooty black, tinged with brown on the under surface; forehead, lores, chin and throat grey. Bill and feet black. Iris dark brown. Bill 36-37.4, wing 311-323, tail 121-132, tarsus 43-46, mid toe 60-64 mm. *Nestling* covered with long blackish brown down. *Colour varieties.* Sandager states that he once examined on Mokohinau a young bird of a uniform dirty-white colour. According to him, the Maoris usually find one or two white individuals every year among the thousands of young birds captured for food. There is a specimen mottled brown and white all over from Whangamata in the Auckland Museum.

Eggs. Clutch one, ovoid, white, 65.5 x 49, 67 x 48.5 mm. Cuvier Island.

Status. Easily distinguishable from all other New Zealand resident members of the genus by its entirely dark coloration. The

Grey-faced Petrel, *P. m. gouldi,* differs from the typical subspecies, *P. m. macroptera,* of the South Atlantic and Indian Oceans in the larger size and greyer face.

Distribution. Breeds in several localities on the mainland and on many islands in the Auckland Province. On the West Coast it breeds north of Manukau Heads. It breeds also on Mount Maunganui at the entrance to Tauranga Harbour and near Gisborne. The principal islands where it is known to breed are Three Kings, Poor Knights, Mokohinau, Hen and Chickens, Little Barrier, Great Barrier, Cuvier, Aldermans, Mayor, White Island and Whale Island. Specimens have been found on Raoul Island but the species is not known to breed there. They have been picked up at Palliser Bay, New Brighton and Lyttelton Harbour.

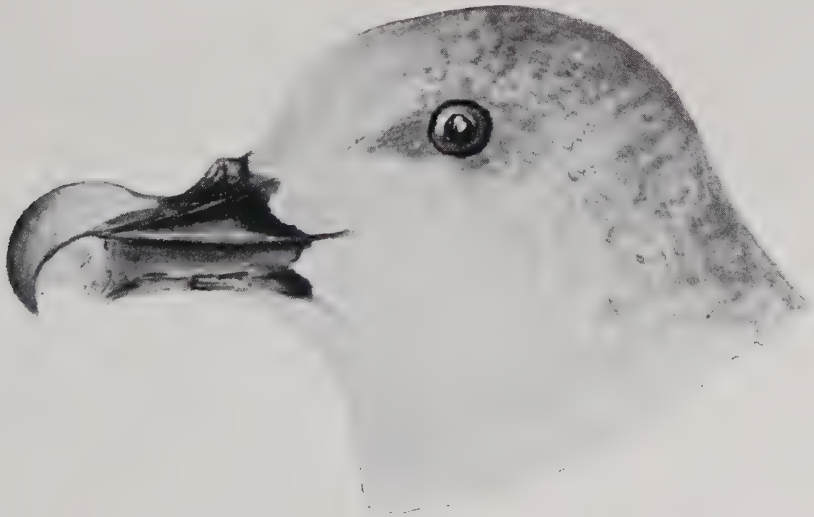
Breeds on the coast of Western Australia south of 25° S. lat.

Habitat. The breeding places of the Grey-faced Petrel in New Zealand lie within the subtropical zone of ocean waters, but in the Indian Ocean the typical subspecies is found in the subantarctic zone reaching its southern limit in Kerguelen. The Grey-faced Petrel frequents the oceans far distant from the land. It is seldom seen near the coast except when actually arriving at or departing from its breeding ground. Probably therefore its feeding ground is some hundreds of miles from its breeding place.

Food. So far as is known, the food of this species consists of cephalopods, crustacea and other pelagic organisms.

Nesting. The Grey-faced Petrels breed on most of the offlying islands of the Auckland Province. They always make their burrows near the shore; if there is no cliff, then quite close to high-water mark, otherwise they are found in the scrub at the tops of the cliffs. Their burrows are two to four feet in length with an enlarged space at the end in which a few leaves form the nest. On Mokohinau, Sandager records that the birds begin to burrow in March and continue to do so until the middle of June when nesting material is carried in. From May up to the end of June when laying commences, both birds are found in the burrows during the daytime. The young leave during the latter part of December and first week in January.

My own observation on White Island and Taranga confirm Sandager's account, in both localities nearly fully fledged young being



C. McCann

GREY-FACED PETREL

found in early December. On Cuvier Island eggs have been collected during the first week in July. Apparently breeding colonies have different times of laying. Falla states that in February and March males are found in the burrows. From April to June pairs are found during the day. According to the same observer laying takes place at the end of July and early in August. The young are hatched about the end of August and may be found in down in October. Various stages of feathering are found in October and November and the young leave the nests during January.

Reischek says that on Little Barrier Island eggs are laid at the beginning of September, a much later date than recorded by other observers.

Maori. Formerly large numbers of these birds were eaten by the Maoris. In December, 1888, according to Sandager, 3,000 young birds were taken from the Mokohinau group. More recently (1947) 3,500 birds were reported to have been taken in ten days in the same islands. In the Bay of Plenty the Maoris regularly visit all the islands where these birds breed and collect and pot down the young.

References.—Smith Ill. Zool. S. Afr., Aves., p. 52, 1840 (*Procellaria macroptera,* Cape seas). Hutton, Trans. N.Z. Inst., 2, 79, 1870 (*Aestrelata gouldii,* Auckland Province). Buller, Birds N.Z., pp. 304, 308, 1873 (*P. fuliginosa,* col. pl., *P. gouldi*) ; 2nd ed., 2, pp. 221, 245, 1888. Reischek, Trans. N.Z. Inst., 18, 90, 1886. Sandager, Trans. N.Z. Inst., 22, 298, 1890. Godman, Monogr. Petrels, 176, col. pl., 1907. Falla, Rec. Auck. Mus., 1, 255, 1934. Murphy, Ocean. Birds S. Amer., 2, 689, 1936.

FAMILY DIOMEDEIDAE
ALBATROSSES, MOLLYMAWKS

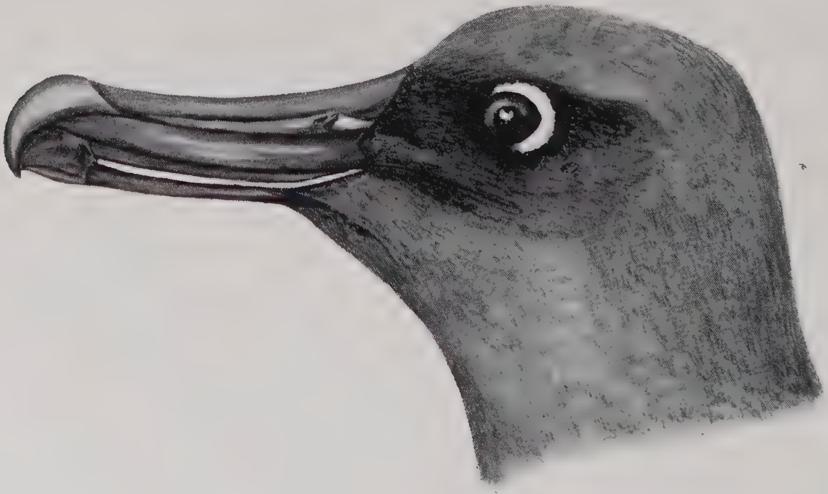
Bill powerful, strongly hooked at tip, the nasal tubes lateral, separated by the base of the culminicorn. No hind toe.

Key to Genera

- Lower mandible with long lateral grooves filled with coloured skin .... *Phoebetria*
- Lower mandible without lateral grooves.
  - Latericorn widened at base, lower angle in advance upper .... *Thalassarche*
  - Latericorn not widened at base, upper angle in advance of lower .... *Diomedea*

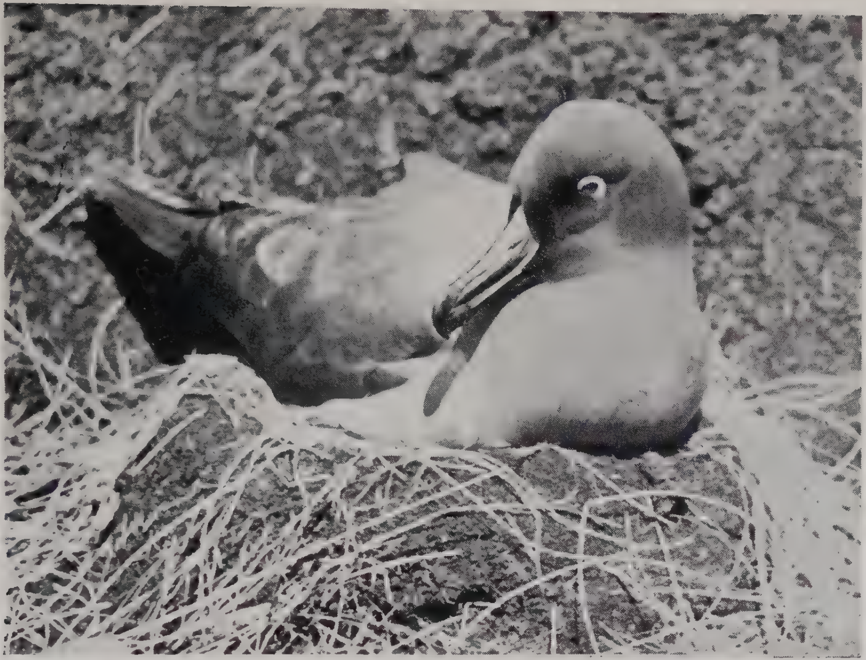
GENUS PHOEBETRIA

Bill with the nasal tubes exposed from the base of the bill and separating the bases of culminicorn and latericorn; a longitudinal



C. McCann

SOOTY ALBATROSS



Campbell Island *J. H. Sorensen*

SOOTY ALBATROSS

groove filled by a coloured membrane on each side of the lower mandible. Tail long, wedge-shaped.

Phoebetria is easily separable from *Diomedea* and *Thalassarche* by the grooved mandible, more exposed nasal tubes and wedge-shaped tail. The latericorn resembles that in *Diomedea.* Two species are found in the southern oceans. *P. fusca* is said to have occurred in New Zealand seas but the evidence is not satisfactory.

Light-mantled Sooty Albatross. Toroa-pango
Phoebetria palpebrata

The "Albatross with white eyebrows" taken during Cook's first voyage in the South Indian Ocean was an example of this species, and formed the basis of Forster's description of *Diomedea palpebrata* published in 1785. In the New Zealand region it appears to have been first collected in 1856 when a gale-stranded specimen was found on the Wairarapa Plains. In 1888, its breeding places were discovered at the Auckland, Campbell and Antipodes Islands by Reischek. H. Hamilton, in 1911, found it breeding on Macquarie Island.

Adult. Head sooty brown, blackish on lores, a nearly complete ring of white feathers, broken in front, encircles the eye; mantle pale ash grey; back and under surface brownish grey. Wings dark slaty brown; primaries greyish black, the shafts white except at the tips; tail greyish black, the feathers with white shafts. Bill black, the groove in the lower mandible pale blue. Iris dark brown. Feet flesh grey, claws white. Bill 100-115, wing 510-580, tail 250-320, tarsus 75-86, mid toe 115-135 mm. *Immature.* Similar to the adult except that the quill shafts are brown or horn coloured. *Nestling.* On hatching powdery grey, sides of head a lighter shade. Campbell Island. (Sorensen.) Second down long, light grey, much darker and shorter on the head. Face in front of and round eye white. Bill black. Feet greyish black, toes pale grey. Auckland Island. (March 31.)

Eggs. Clutch one, elliptic oblong, one end slightly broader than the other, white with a zone of reddish brown spots on the larger end. 98 x 65, 103 x 67, 100 x 64.5, 107 x 65.5 mm. Campbell Island. (Sorensen.)

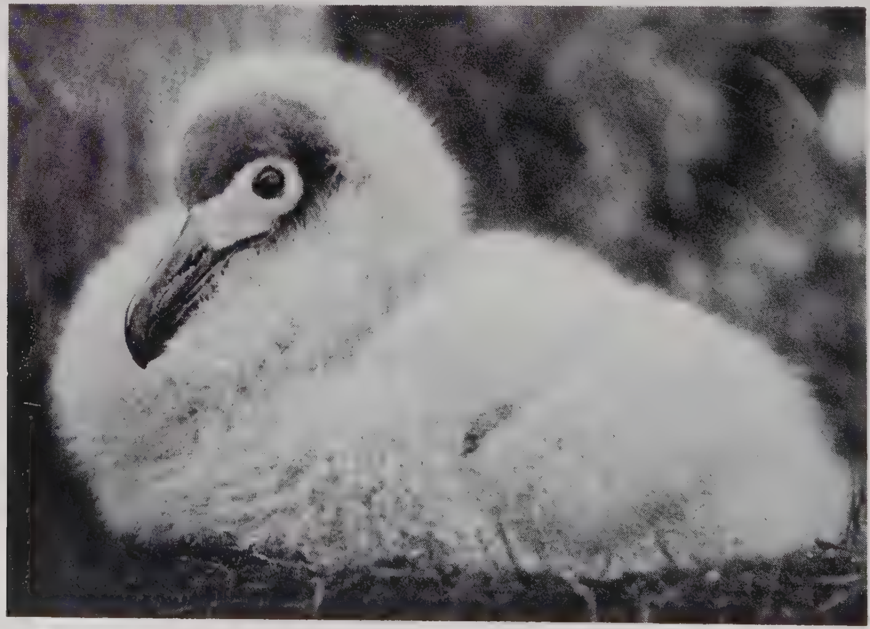
Status. Distinguished from the Sooty Albatross (*P. fusca*) by the light mantle and pale blue stripe on the lower mandible.

Distribution. Breeds at Auckland, Campbell, Antipodes and Macquarie Islands. Common in the New Zealand seas from Cook Strait southwards. Sight records at the Kermadecs, Three Kings, Milford and Dusky Sounds. Specimens collected at Kohukohu, Muriwai, Paeroa, Palliser Bay, New Brighton, Halswell and Lake Ellesmere.

The southern oceans from South latitude 30° to the Antarctic continent. Breeds at South Georgia. Kerguelen, Crozet and Prince Edward Islands.

Habitat. Though always to be seen in the seas surrounding New Zealand, only a few pairs or single birds of the Light-mantled Sooty Albatross are observed at a time. On one occasion Captain Fairchild reported off Milford Sound the rather unusual occurrence of about a dozen coursing about together. This species is perhaps the most perfect sailer or glider of all sea birds, it seldom being seen to flap its wings. In flight, the wings are kept straight out from the body without the appearance of being slightly flexed as in the Wandering Albatross. It frequents the oceans far from land, only coming ashore to almost inaccessible sea cliffs to breed.

Nesting. Unlike the true albatrosses and mollymawks, the Light-mantled Sooty Albatross does not breed in large colonies but nests singly on the ledges and slopes of sea cliffs, usually with cliff above and below so as to be almost or quite inaccessible. It always betrays the presence of its nest by wheeling overhead. On the cliffs along the north side of Carnley Harbour in the Auckland Islands, two nests were visited on March 31st. They were placed on ledges 30 to 40 feet above the water among tussocks of *Poa foliosa.* The nests were volcano-shaped, about two feet in diameter at the base and fifteen inches across the rim



Campbell Island *J. H. Sorensen*

SOOTY ALBATROSS CHICK

which was four or five inches in height. They were made of earth and leaves of Dracophyllum and grass and evidently were made by the parents scraping together all the surface soil within reach. In the first nest was a nestling in down with the first feathers appearing on the wings and back. This youngster did not seem much afraid, but sat up when approached closely and snapped its bill the whole time. In the second nest was an adult and a nestling bird.

The life history of the Light-mantled Sooty Albatross on Campbell Island was investigated by J. H. Sorensen through several seasons so I have taken the following information from his report. The birds arrive at the island during the first week in October. It would seem that the Sooty Albatross, like the Royal Albatross, apparently mates for life. Sorensen records that a fledgling of May, 1945, was found breeding in January, 1947. This would mean that the bird mated when less than two years old. The birds usually return to the same locality but always construct a new nest each season. Any site will suit so long as it has steeply falling ground below to give room for the take off. The birds take off by propelling themselves outward, no run is taken.

Towards the end of October, states Sorensen, the birds commence the construction of a nest and the female does most of the work. A good deal more is done to the nest during incubation. The birds are continually plucking at nearby herbage whilst on the nest, and soil or mud is plastered on with the sides of the bill used trowel fashion. The eggs are laid from October 31st and during the first week in November. Both birds share the incubation period. The chicks are hatched between January 3rd and 6th. The incubation period is therefore approximately nine weeks, 63-67 days.

The second down appears during the second week and the feathers on the back and wings begin to appear during the seventh week. By the eighteenth week, early May, all the down has disappeared except a tuft on the forehead, thighs and lower part of belly. The young leave the nest during the twentieth week, that is, the third week in May. (Sorensen.)

Food. Consists of small pelagic animals procured from the surface of the ocean, mainly squids and fish.

Voice. Falla describes the call of the Light-mantled Sooty Albatross on Kerguelen thus: "Both the older birds were uttering at intervals the double call that is usually associated with mating, a shrill 'pee' with the bill pointed skyward and a final 'arr' with the bill pressed in against the foreneck." Sorensen says that this description is remarkably adequate for Campbell Island birds.

References.—Forster, Mem. Acad. Roy. Sci., 10, 571, 1785 (*Diomedea palpebrata,* South Indian Ocean); Desc. Anim., 55, 1844. Gmelin, Syst. Nat., 568, 1789 (*D. fuliginosa,* same bird). Mathews, Birds Austr., 2, 297, 1912 (*P. p. huttoni,* New Zealand). Buller, Birds N.Z., 296, 1873; 2nd ed., 2, 205, 1888. Mathews and Iredale, Man. Birds Austr., 1, 49, col. pl. bill., 1921. Murphy, Oceanic Birds S. Amer., 1, 497, 1936. Falla, B.A.N.Z.A.R.E., ser. B, 2, 130, 1937. Sorensen, Light-mantled Sooty Albatross, 1950 (Bull. Cape Exped., 8).

Genus Thalassarche

Bill with the culminicorn little or not at all widened at the base; base of latericorn widened and with the lower angle in advance of the upper. A membrane between the culminicorn and latericorn behind the nostrils. Tail short and rounded.

Thalassarche differs from Diomedea in the characters of the bill especially in the wide base of the latericorn with the lower angle in advance of the upper, and in the presence of a membrane behind the nostrils. This membrane varies in extent being narrow in *T. melanophris* and *T. bulleri;* in the other species it is wider and extends round the base of the culminicorn. It is coloured yellow in *T. melanophris* but is black in the remaining species.

Five species ranging over the southern oceans.

Key to New Zealand Species

- Culminicorn scarcely or not at all widened at the base; membrane wide behind the culminicorn.
  - Culminicorn not widened at base, bill black with yellow culmen.
    - Base of culminicorn pointed; membrane behind broad .... *T. chlororhynchus*
    - Base of culminicorn rounded, membrane behind narrow .... *T. chrysostoma*
  - Culminicorn slightly widened at base.
    - Bill bluish.
      - Head white .... *T. c. cauta*
      - Head grey .... *T. c. salvini*
    - Bill yellow, head dark grey ...... *T. c. eremita*
- Culminicorn distinctly widened at the base, membrane narrow, a very narrow line round base of culminicorn.
  - Bill black with yellow above and below; membrane black .... *T. bulleri*
  - Bill yellow, membrane yellow ...... *T. melanophris*

References.—Reichenbach, Nat. Syst. Vog. 5, 1852 (*Thalassarche,* type *Diomedea melanophrys,* Temn.)

Yellow-nosed Mollymawk

Thalassarche chlororhynchus

About 1930 R. A. Falla found a bird of this species on the beach at Muriwai, west coast of Auckland. The same observer sighted eight birds at sea off the Three Kings in 1932.

Adult. White, with greyish tinge on cheeks and sides of neck; a dark grey mark in front of eye; back and wings dark brown, the upper back tinged with grey; tail hoary grey. Bill black, culmen yellow, passing into orange at the tip. A yellow strip of membrane at the base of the mandible. Feet flesh colour. Bill 105-124, wing 456-499, tail 177-199, tarsus 74-84, mid toe 103-116 mm. *Immature.* Head white. Bill black.

Eggs. Clutch one, white with brownish-red specks and blotches on the larger end. 94.5 x 60, 97.1 x 64, 101.1 x 65.4 mm. Nightingale Island.

Status. Allied to *T. chrysostoma* but the culminicorn is pointed behind and there is a wide membrane between its posterior border and the frontal feathers. The mandible differs in not having its lower margin yellow.

Distribution. Visitor to northern seas. Muriwai. Observed at sea off North Cape and Three Kings Islands.

South Atlantic and Indian Oceans, straying to east Australian and New Zealand seas; breeding on Tristan da Cunha, Gough and St. Paul Island.

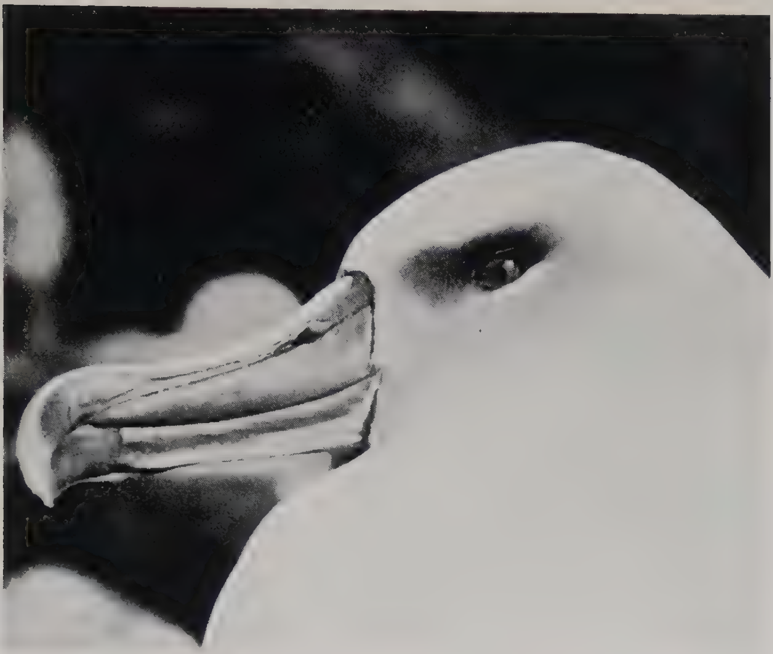
References.—Gmelin, Syst. Nat., 568, 1788 (*Diomedea chlororhynchus,* Cape seas). Godman, Monogr. Petrels, 357, col. pl. 1909. Murphy, Ocean. Birds, S. Amer., 1, 518, 1936.

Grey-headed Mollymawk

Thalassarche chrysostoma

Hutton's record, in 1869, of *T. chlorohyncha* being taken off the Great Barrier Island almost certainly refers to this species. In 1874 Filhol recorded *T. chlororhyncha* as breeding on Campbell Island and it is now known that the species he saw was the Grey-headed Mollymawk. This species was seen at sea near Macquarie and Auckland Islands by the Antarctic expeditions of 1901 and 1904. There are several instances of birds found washed ashore on the New Zealand coast, the earliest being at Kapiti and Muriwai in 1932. When a coast watching party was established on Campbell Island in 1942 an opportunity was given to investigate the life history of this species.

Adult. Base of culminicorn narrow, rounded behind, membrane wide meeting round base of culminicorn. Head and neck bluish grey, paler on the forehead, a slaty black mark through the eye; back and tail dark grey; wings blackish brown. Rump, upper tail coverts and under surface white. Bill black, the culmen yellow and the tip pink; lower half of lower mandible yellow. A yellow strip at the base of the mandible Iris brown. Feet grey, webs pinkish, claws ivory. Measurements of South Atlantic specimens: bill 106-122, wing 473-555, tail 175-205, tarsus 79-91, mid toe 111-138 mm. (Murphy.) Campbell Island specimens fall within these limits. *Immature.* Head dark slate, pale on chin and throat, sooty slate patch through eye. Back blackish brown; wings brownish black; tail slaty black. Lower



Campbell Island *J. H. Sorensen*

GREY-HEADED MOLLYMAWK

back white, feathers broadly edged with brown. Under surface white, sides of breast slaty grey. Iris dark brown. Bill blackish brown, lighter on middle portion of upper and basal part of lower mandible. Feet bluish white. *Nestling* covered with grey down. Eyes dark brown. Bill black. Feet pinkish grey. (Sorensen.)

Eggs. Clutch one, elliptical, slightly smaller at one end, white, a broad band of brown marks and stippling at the larger end. 112 x 68, 114 x 68, 118 x 69 mm. Campbell Island.

Status. The narrow rounded base of the culminicorn distinguishes this species from *T. chlororhynchus* on the one side where it is much narrower and pointed, and *T. cauta* on the other where it is slightly widened. The colour of the bill, especially the broad yellow bands on the lower as well as the upper mandible, is quite distinctive.

Distribution. Breeds on Campbell and Macquarie Islands. Recorded at sea near the Auckland and Antipodes Islands. Adult and immature birds regularly visit New Zealand waters. Specimens have been obtained off Great Barrier Island, on the beaches at Muriwai, Kapiti Island, Te Horo, Pukerua Bay, Palliser Spit and Whakatiki, and inland at Halswell.

The southern oceans from about 40° south latitude to the Antarctic ice. Occasionally strays into the North Atlantic and North Pacific Oceans. Breeds on Diego Ramirez Islands, Falkland Islands, South Georgia, Crozets, Prince Edward Island and Kerguelen. Visitor to southern Australia and Tasmania.

Habits. Sorensen found cuttle fish beaks in the stomachs of this mollymawk. He states that when sheep come near the nest the young back out. They are unable to climb into the nest and some may fall over the cliff and perish.

Nesting. The following notes have been supplied by R. L. Oliver who spent most of 1945 on Campbell Island. In September the nests are occupied and mating takes

Campbell Island *J. H. Sorensen*
GREY-HEADED MOLLYMAWK FEEDING CHICK

place. Egg laying begins in early October; on the 17th practically all the nests were occupied and there were fresh and partly incubated eggs. Chicks were fully fledged by mid April, most with some down on them and a few completely covered with down. The young were being fed by the parents at this time. On April 20th there were many empty nests, the young having flown. Sorensen states that the chicks were from two to seven days old on December 27th and the young were still present on May 6th. In South Georgia, according to Gibson-Hill, the period of incubation is about seven weeks.

The Grey-headed and Black-browed Mollymawks breed in the same colonies on Campbell Island. A description of these by J. H. Sorensen will be found under the latter species.

References.—Forster, Mem. Acad. Roy. Sci., 10, 571, 1785 (*D. chrysostoma,* Cape seas); Desc. Anim., 24, 1844. Gould, Proc. Zool. Soc., 1843, p. 107 (*D. culminata,* Cape seas). Godman, Monogr. Petrels, 354, col. pl., 1910. Mathews and Iredale, Man. Birds Austr., 1, 51, col. pl. bill, 1921. Falla, Rec. Auck. Mus., 1, 178, 1933.

White-capped Mollymawk

Thalassarche cauta cauta

The White-capped Mollymawk was first collected in Bass Strait and was described by Gould in 1840. In the New Zealand region a breeding colony was discovered by E. R. Waite in 1907 on Disappointment Island in the Auckland group. (Waite referred it to the black-browed mollymawk but published a photograph showing the species to be the White-capped Mollymawk.) This subspecies was observed by myself at Half Moon Bay in 1926 and E. F. Stead collected it at Port Pegasus in 1931 and at Half Moon Bay the following year.

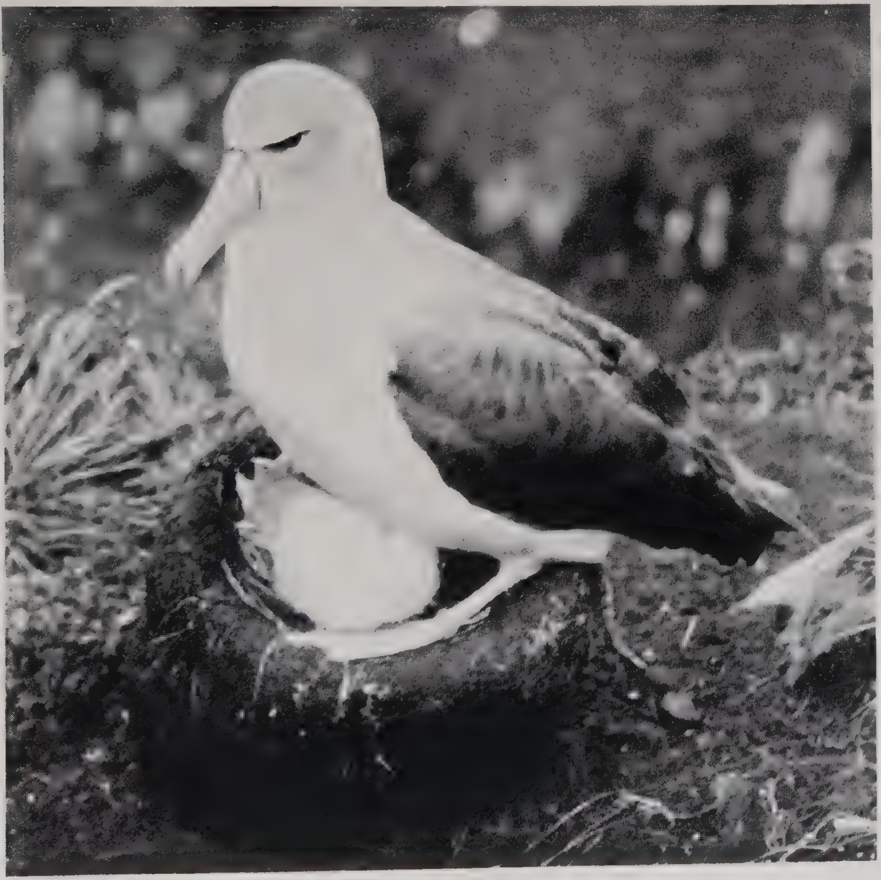
Adult male. Head, neck, and under surface white. Eyebrows and patch in front of eye dark grey; cheeks and patch behind eye pale grey. Upper back slaty grey; lower back, rump and upper tail coverts white; scapulars and tail ash brown; wing coverts dark brown; primaries dark brown with white shafts, inner web white except along shaft and at tip. Bill buish yellow, hook of both mandibles bright yellow, membrane round base of culminicorn black. At base of mandible is a strip of orange separated from the feathers by a black line; it extends to the gape and about 50 mm. behind it. Iris dark brown. Feet bluish white. Bill 132-140, wing 555-610, tail 220-252, tarsus 90-95, mid toe 132-143 mm. *Immature.* Immature birds associated with *cauta* in Foveaux Strait have grey heads paler on the crown and throat; inner webs of primaries black; bill pale cream with dark subterminal patch. They agree with *T. c. salvini* except for the cream bill. *Nestling.* Covered with long pale slaty down. Bill black. Eye dark hazel. Feet flesh colour. Auckland Island.

Eggs. Clutch one, elliptic, surface rough and without gloss, white with a freckled band of reddish brown at one end. 100 x 70, 105 x 69, 108 x 71, 110 x 73 mm. Auckland Islands.

Status. T. cauta is the largest of the species of *Thalassarche* and is further distinguished from the other species by the bluish bill, except *T. c. eremita* which has a yellow bill. The typical subspecies, *T. c. cauta,* is distinguished from the other subspecies by its larger size, more white on the head, large white patch on inner webs of primaries and the bluish yellow bill.

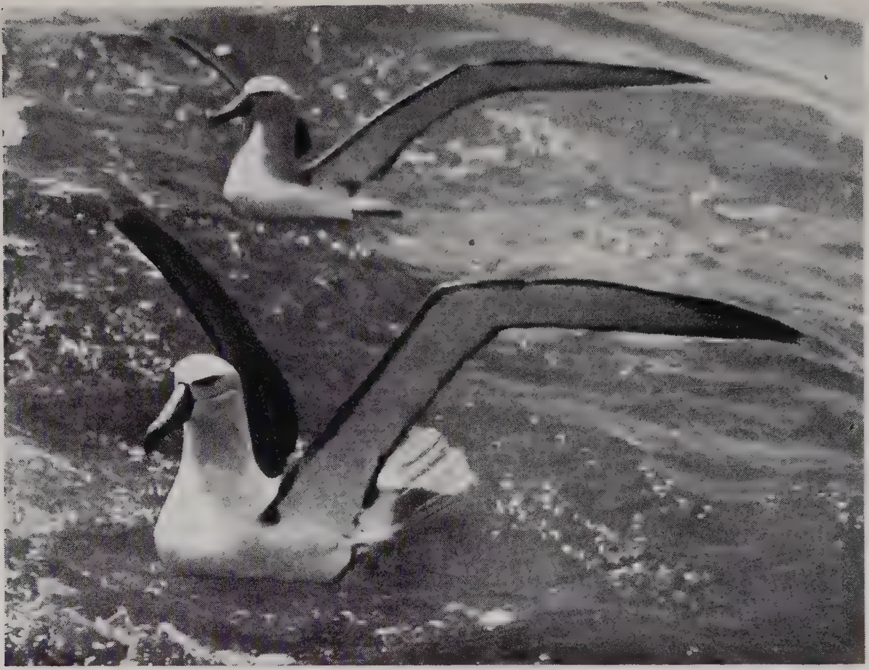
Distribution. New Zealand seas to eastward of the Chatham Islands. Breeding on Auckland and Disappointment Islands.

Tasmania and the southern coast of Aus-



Auckland Island *J. H. Sorensen*

WHITE-CAPPED MOLLYMAWK



Stewart Island *R. A. Wilson*

WHITE-CAPPED MOLLYMAWK

tralia, breeding on Albatross Island and other islands in Bass Strait and on Pedra Branca Island south of Tasmania.

Food. What food the White-capped Mollymawk takes from the surface of the ocean is not known, but how it may adapt itself to changed conditions may be seen almost every day at Half Moon Bay, Stewart Island. A number of these birds regularly follow the fishing boats, while the fish are being cleaned, into the bay. Coming almost up to the wharf they frequently settle on the water until another boat is sighted when they go out to meet it. When the boats are drifting with the wind, fishing, this species as well as Bullers Mollymawk settles a few yards from the boat and scrambles for any fish thrown overboard.

Nesting. Waite writes: "On Disappointment Island we came across their nesting grounds. The nests are made on a rather steep slope, clothed with Ligusticum and consist of a conical mound, varying in height from eight inches to eighteen inches. The nest is constructed of mud mixed with vegetable substances scraped from around and the cup-shaped depression is lined with finer materials. The birds sit but a few feet apart, and they dot the whole of the hillside."

References.—Gould, Proc. Zool. Soc., 1840, 177, 1841 (*D. cauta,* Bass Strait). Godman, Monogr. Petrels, 348, col. pl., 1910. Falla, Rec. Auck. Mus., 1, 179, 1933 (*T. c. steadi,* Foveaux Strait).

Bounty Island Mollymawk

Thalassarche cauta salvini

Before the Subantarctic Islands of New Zealand were explored a few specimens only of the Bounty Islands Mollymawk were obtained on the New Zealand coast. The earliest records are Blueskin Bay 1876, Wellington 1877 and Manukau Harbour 1888. Reischek visited the Southern Islands in January 1888 and found this mollymawk breeding on the Bounty Islands. He also stated that it bred at the Snares. Rothschild described the present subspecies under the name *Thalassogeron salvini* in 1893.

Adult. Slightly smaller than *T. c. cauta*. Differs also in its grey head with greyish white forehead and crown, and brown inner webs of the primaries. Bill grey, culmen lemon yellow, pinky yellow along the base of mandible (orange in the breeding season), hook of upper mandible horn colour, of lower mandible slaty black. Bill 117-135, wing 523-585, tail 188-228, tarsus 75-95, mid toe 120-139 mm. *Immature*. Bill darker, head grey with the white of the forehead hardly extending back beyond the level of the eyes. *Nestling*. Covered with long, thick light neutral grey down.

Eggs. Clutch one, elliptic, white with faint brown blotches principally at the larger end, 100 x 67, 101.5 x 68.5, 106 x 66, 107 x 69 mm. Bounty Islands.

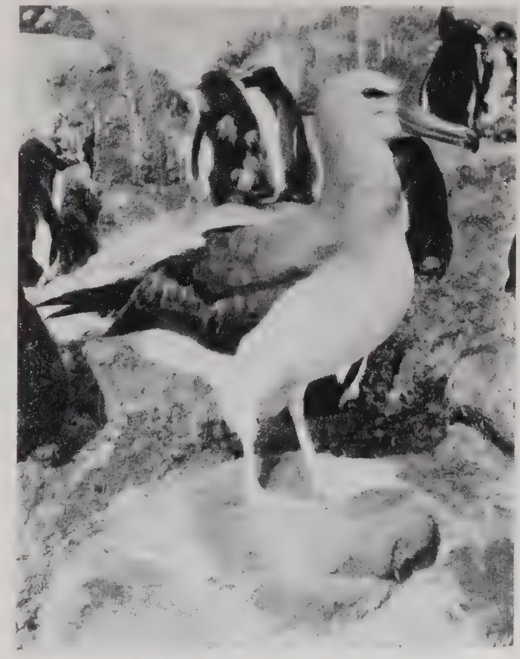
Distribution. Breeds on the Bounty Islands and western reef of the Snares group. Birds of this subspecies or *cauta* have been recorded from the Three Kings, Great Barrier Island, Doubtless Bay, Dargaville, Hauraki Gulf, Manukau Harbour, off East Cape, Wanganui, Kapiti Island, Palliser Bay, Cook Strait, Kaikoura, Banks Peninsula and Stewart Island.

South Pacific, Atlantic and Indian Oceans. Has been taken off the coast of Chile, Peru and South Africa. Known to breed only in the New Zealand region.

Nesting. Perhaps the most remarkable thing about the bird life on the Bounty Islands is the complete intermixture of species which breed there. The Erect-crested Penguin is found on every available site where a foothold can be obtained and scattered freely among these birds are the nests of the Bounty Islands Mollymawk. This species is able to build its nest on sloping surfaces and other places where the penguin would have difficulty in sitting on its egg. There is no vegetation, other than marine algae, on the islands. Indeed the conditions are too severe to permit of its growth; in summer the surface is sprayed with bird excrement, in winter the waves pass over it. The only materials plentiful at all are penguins' bones, guano and feathers, and it is of these that the Mollymawk constructs its nest. It is quite solid and is small for the size of the bird which evidently would cover it when sitting. It averages about 14 inches in diameter with a shallow hollow about 8 inches across. The height varies according to the surface, and if situated on a slope, one side will be built up higher than the other in order to make the top horizontal. The sides average from four to six inches in height. The Bounty Islands are visited so infrequently that it is not known exactly when the Mollymawks lay. On April 4th the young were fully fledged and would thus be about four and a half months old. This would indicate that the eggs were laid early in October.

On November 10th 1950 the Antipodes Island expedition found at the Bounty Islands chipped eggs and newly hatched chicks. Rollo Beck on February 27th, 1926, found well grown chicks moulting their down.

References.—Rothschild, Bull. Br. Orn. Club, 1, 58, 1893 (*Thalassogeron salvini*, New Zea-



Bounty Islands *G. M. Turner*

BOUNTY ISLAND MOLLYMAWK

land). Buller, Birds N.Z., 2nd ed., 2, 203, 1888; Suppl., 1 pp. 150, 1905 (*D. salvini,* col. pl. head, *D. cauta*). Godman, Monogr. Petrels, 351, col. pl., 1910. Murphy, Amer. Mus. Nov., 419, 3, 1930; Ocean. Birds S. Amer., 1, 526, 1936.

Chatham Island Mollymawk

Thalassarche cauta eremita

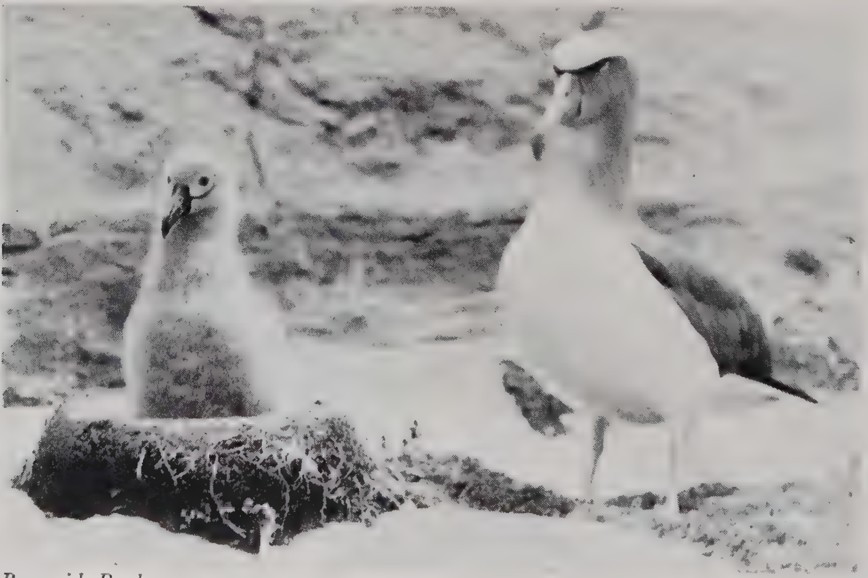
The Chatham Island Mollymawk was one of the discoveries of the Whitney South Seas Expedition, which, under the command of Rollo H. Beck, visited New Zealand in 1926. It was found breeding on Pyramid Rock in that group.

Adult. Differs from *T. c. salvini* in its slightly smaller size, dark grey head and bright yellow bill. Forehead greyish white, shading to grey on the crown; a dark grey band from top of bill to eye; remainder of head slaty grey, with throat and foreneck whitish; back greyish brown, rump and upper tail coverts white; tail slaty brown, shafts white. Wings brownish black; the inner webs of the primaries brown. Breast, abdomen and under tail coverts white. Bill yellow. Iris brown. Feet whitish. Bill 125-126, wing 545-546, tail 209-215, tarsus 85-86, mid toe 125 mm. *Immature.* Head grey, wings and back brown, rump and upper tail coverts white tinged with grey, tail dark grey. Bill dark blackish horn, bare skin black. Nukumaru. *Nestling* in down is described by Fleming as at first dirty white, later ashy grey. Bill and gape brownish black.

Eggs. Clutch one, white, smooth, without gloss, with few or many purplish red dots mainly round the larger end. 97 x 68, 102 x 65, 104.5 x 67.5 mm. (Fleming.)

Distribution. Breeding on Pyramid Rock, Chatham Islands. Specimens have been found at Rakaia mouth, Karekare and Nukumaru on the New Zealand coast. One observed off Whangaroa Harbour.

Nesting. Concerning the breeding colony of the Chatham Island Mollymawk on Pyramid Rock Fleming writes as follows: "Mollymawks were extremely abundant over the whole islet as far as could be observed from the boat. Wherever there was sufficient foundation, nests were found, even on small ledges on the precipitous wall of the main cone where there was barely standing room for birds beside the nests. There is a certain amount of reddish soil in parts, and



Pyramid Rock *E. G. Turbott*

CHATHAM ISLAND MOLLYMAWK

wherever it can obtain a hold, a succulent yellow-flowered plant (*Cotula Renwicki*) grows. The nests seem to be composed of this red soil and were on an average a foot in diameter and nine inches high, with a shallow cup. Most of the nests were at this date (December 16th) occupied by downy nestlings. In some cases they were attended by their parents, but more often they sat alone, upright, facing the intruder and at intervals of a few seconds they squirted a jet of yellow oil to a distance of four feet with distressing accuracy."

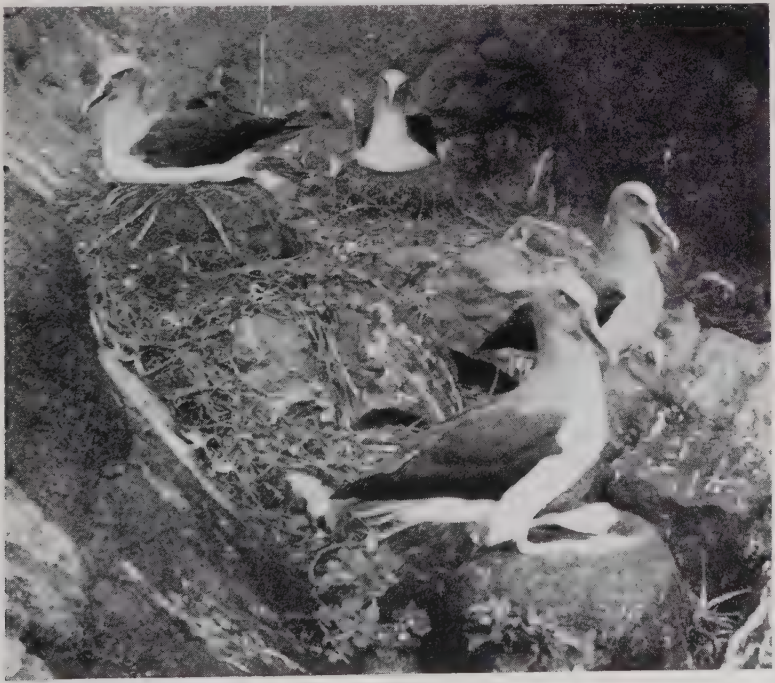
References.—Murphy, Am. Mus. Nov., 419, 5, 1930 (*T. c. eremita,* Chatham Islands). Fleming, Emu, 38, 393, 1939.

Bullers Mollymawk

Thalassarche bulleri

A few specimens of this species were obtained on the coast of the South Island before 1870. They were referred to *Diomedea culminata* under which name the species appears in the first and second editions of Buller's work. In 1893, Rothschild showed that the New Zealand species was quite distinct from any other and described it as *Diomedea bulleri.* Its breeding place was discovered at the Snares by Reischek in 1888. Rollo Beck found it breeding on the Forty-fours and Round Rock in the Chatham group in 1926.

Adult. Front and crown white; a greyish black patch through the eye. Head pale grey, darker on face below eye and paler on chin and throat. Hind neck and mantle brownish grey. Back brown, lower back and upper tail coverts white. Wing blackish brown, quill shafts ivory except at tips. Tail greyish brown, shafts ivory. Chest, abdomen, flanks and under tail coverts white. Culminicorn, unguis and lower half of mandible bright yellow; latericorn and upper and terminal parts of mandible satiny black. Bare skin at gape orange. Membrane round base of culminicorn, including nostrils, and at base of latericorn jet black; membrane at base



Sisters Rocks, Chatham Islands *E. W. Dawson*

BULLERS MOLLYMAWK

of mandible orange, at its lower end projecting a little into the yellow of the bill. Iris brown. Feet bluish flesh colour, tinged with purplish on tibia and joints of outer toe, claws ivory. Bill 115-126, wing 462-526, tail 175-202, tarsus 75-85, mid toe 110-124 mm. Chatham Islands. (Murphy.) *Immature.* Similar to the adult but bill dark horn colour. *Nestling.* Covered with long pale smoky grey down, short on chin and face. Bill dark brown, tips dark horn colour. Feet yellow, claws ivory.

Eggs. Clutch one, nearly elliptical, white with brownish red specks, mostly merged, at the larger end. 93 x 63.2, 102 x 65, 105.5 x 68.7 mm. Snares.

Status. The slightly widened base of the culminicorn allies this species to the Black-browed Mollymawk but the two-coloured bill and grey head at once distinguish it. It can be distinguished from the Grey-headed Mollymawk by the broad base of the cuminicorn.

Distribution. Breeds at the Snares, the Solanders, and on the Sisters, Forty-fours and Round Rock in the Chatham group. On the New Zealand coast specimens have been obtained at Anawhata (west coast of Auckland), Palliser Spit, Akaroa, Port Chalmers and Dusky Sound. It is common around Stewart Island and has been collected on the Auckland Islands.

Straggles eastward to Peru and Chile.

Habitat. So far as is known this is a stationary species, it not having been observed in any numbers far away from its breeding grounds. The four records from South America, one an immature bird, were apparently stragglers. Off the coast of Stewart Island it associates with the White-capped Mollymawk and like it has developed the habit of attending fishing boats and following them into port.

Nesting. A period of seven weeks, in January-February 1948, was spent by L. E. Richdale on the Snares Islands, mainly studying the habits of Bullers Mollymawk, so the account of the nesting of this species will be taken from his publications. After its non-breeding season at sea, writes Richdale, Bullers Mollymawk arrives on the Snares Islands near the middle of December. The males tend to arrive before their own mates and it appears that they were already mated on arrival. The longest period noted of a breeding male coming ashore before the laying of the egg by his mate was 32 days. The mollymawks arrive over a period of seven weeks.

The nests are scattered irregularly over the full length of the occupied coastline. But there is a tendency for mated pairs to form little groups apparently as an expression of social inclination. The nests are found on open coastal cliffs, where the birds can take off at or near the nests, or in the *Olearia* forest. In the latter case the birds land on the forest edge and walk through the trees to their nests. A common feature is the proximity of, or easy access to, a taking off place which either directly overlooks or slopes steeply to the water.

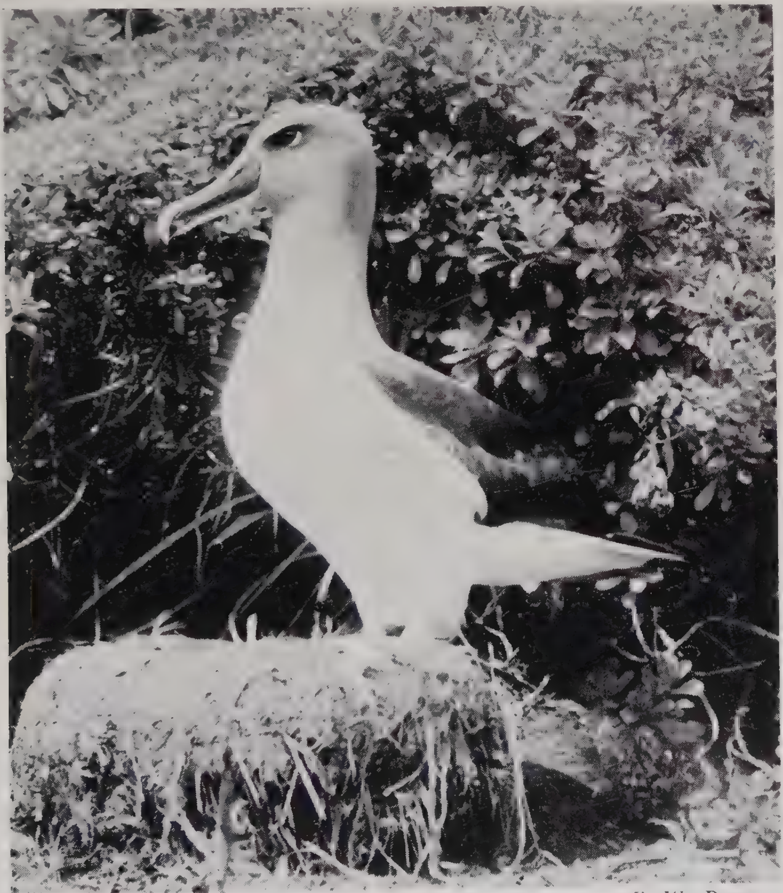
The nest is constructed by the bird sitting down on the chosen site from which position it reaches out and loosens the soil all around it or, if the vicinity contains vegetation, this is torn to pieces. The debris is gradually placed under the bird as the nest is built higher and higher. At first the sides slope considerably but as the building proceeds the sides gradually become vertical. The material is added beakful by beakful and is patted down with the side of the anterior end of the beak. The bird keeps turning slowly and its feathers, especially in wet weather, become very dirty in the process.

According to Richdale the nest is begun and practically completed by the male. The female puts the finishing touches to it when she is waiting for the egg to pass down the oviduct. In some cases the female alone may do the building.

The first egg noted was laid on 16 January. Egg laying continued probably until early in March, so the range was fully seven weeks. The male begins incubating usually the day after the egg is laid, occasionally the day the egg is laid. Both sexes share, approximately equally, in incubating the egg. There are about 350 nests of Bullers Mollymawk on the Snares Islands.

On the Solanders, on December 9, Falla reports 20 or 30 pairs circling the hillsides. Old nests were found at all levels from 50 to 600 feet. Some were like truncated cones, others with a more cylindrical column nearly a foot high. Where a ledge is not naturally wide enough to allow a bird to manoeuvre and use its wings, considerable excavation, presumably with bills, has been done in the banks at the back. This includes the cropping off of exposed roots. Later in the year, July 20, Falla again landed on the Solanders and found Bullers Mollymawks at sea all round the islands in great numbers and dotted conspicuously over their nesting sites on both islands. Two or three hundred occupied nests on Little Solander were in very exposed situations on the steep slopes among *Poa foliosa*. On the big island many were in better shelter and some far enough under *Hebe* bushes to cause the adults to crouch and dodge branches when approaching them.

The young birds on the Solanders at the time of Falla's visit, July 20, were "practically all well fledged with less down than contour feathers; some certainly could have flown in less than a fortnight from that date." From this evidence and that of Fleming's for the Chathams, namely, full grown birds without down on August 5th, it can be concluded that the young Bullers Molly-



Sisters Rocks, Chatham Islands *E. W. Dawson*

BULLERS MOLLYMAWK

mawks would be ready to fly in late July and early August, when they would be between four and five months old.

On his visit to the Chatham Islands in 1954 Mr. E. W. Dawson landed on the East Sister on January 29th and reported about 250 pairs of Bullers Mollymawks "nesting on the sloping rocky sides below the top flat, the majority having chicks up to about a week old. There were very few eggs left." Passing quite close to the West Sister he estimated that there were 350-400 pairs. Two of the party landed on the Forty-fours. They estimated the total number of Bullers Mollymawks breeding there at 4000 pairs and stated that nearly all the birds had chicks. Only six eggs were seen, all hatching.

References.—Rothschild, Bull. Br. Orn. Club., 1, 58, 1893 (*D. bulleri,* New Zealand); Ibis, 1893, p. 572. Buller, Birds N.Z., 295, 1873; 2nd ed., 2, 201, 1888 (*D. culminata*); Suppl. 1, 149, col. pl. head, 1905. Godman, Monogr. Petrels, 344, col. pl., 1910. Murphy, Oceanic Birds S. Am., 1, 525, 1936. Falla, N.Z. Bird Notes, 3, 53, 1948. Richdale, Bird Banding, 20, 127, 1949; Pre-egg Stage Bull. Mollym., 1949.

Black-browed Mollymawk. Toroa

Thalassarche melanophris impavida

This beautiful and common species was early known to voyagers in the southern hemisphere and is the species usually known as the Mollymawk. It was described from the Cape seas in 1828. It was first included in the New Zealand fauna on the observation of Hutton who noticed it off Great Barrier Island in 1868. Travers collected it at the Chathams in 1871, and it was discovered breeding at the Auckland and Campbell Islands about the same time.

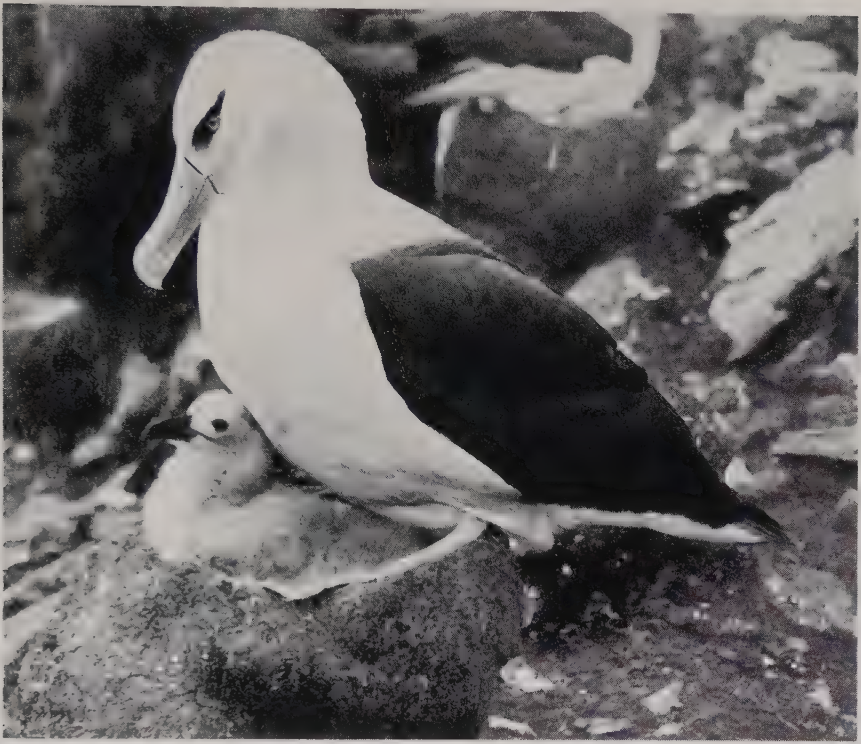
Adult. Culminicorn widened at the base, membrane between culminicorn and latericorn hard and yellow like the rest of the bill. General colour white. A patch of slaty black through the eye. Middle of back and tail dark slaty grey, tail shafts white. Wings brownish black, shifts ivory white darkening towards the tips. Under surface of wing mostly black, the central white portion being rather narrow. Bill yellow, shaded to orange at the hook. Iris yellow. A narrow black line round base of bill. Skin between rami of mandible bluish. Feet fleshy grey, the claws darker. Bill 111-120, wing 500-535, tail 192-210, tarsus 77-88, mid toe 120-132 mm. *Immature.* Head white washed with pale grey, forehead darker, eye-patch dark brown, chin and throat white; lower hind neck brownish; back and wings blackish brown, tail greyish brown with ivory shafts; remainder of body white. Eye dark brown. Bill dark brown, blackish on base of culmen and tips of both mandibles. Feet bluish white. *Nestling* covered with grey down. Eyes dark brown. Bill jet black. Feet light grey. (Sorensen.)

Eggs. Clutch one, elliptic, one end slightly less obtuse than the other, white with faint brown blotches mostly at the larger end, 99 x 68, 103 x 67, 109 x 65 mm. Campbell Island.

Status. The Black-browed Mollymawk differs from the other species of the genus in the narrow, yellow membrane between the culminicorn and the latericorn and in the completely yellow bill. The bill recalls *Diomedea* but the latericorn is quite different in shape, agreeing with the other members of the genus *Thalassarche. T. m. impavida* of Australian and New Zealand seas is distinguished from *T. m. melanophris* of the southern Atlantic, Indian and eastern Pacific Oceans by the darker under wing, lighter coloured eyes and more black in front of the eyes.

Distribution. Abundant in the seas of the New Zealand area; frequents the coastal waters sometimes entering the harbours. Breeds at Campbell, Antipodes and Macquarie Islands. Localities whence it has been observed include the Kermadec Islands, Hauraki Gulf, Great Barrier Island, Mount Maunganui, Kapiti Island, Cook Strait, Akaroa, Dusky Sound, off Stewart Island, and the Snares, Auckland and Macquarie Islands. Seas of southern Australia and Tasmania.

T. m. melanophris breeds on islands off



Campbell Island *J. H. Sorensen*

BLACK-BROWED MOLLYMAWK

Tierra del Fuego, South Georgia, Falklands, Kerguelen and Prince Edward Island.

Food. The food of the Black-browed Mollymawk consists of pelagic animals—squids, crustacea, fish. That it includes an occasional bird is proved by the finding of the remains of a Diving Petrel in the stomach of a storm-killed specimen.

Nesting. Steep slopes on the tops of sea cliffs are the breeding sites of the Black-browed Mollymawk. On the north-east coast of Campbell Island high above the water's edge is an immense colony, rows and rows of birds being seen from the sea on tussocky slopes with cliffs above and below them. Two species, the Black-browed and the Grey-headed Mollymawks, are associated in these colonies. The breeding cycle of *T. melanophris* on Campbell Island is given thus by J. H. Sorensen. The birds arrive during September. Fresh and partly incubated eggs were found on October 14th. On November 2nd the eggs were well incubated. Some chicks were hatched on October 30th. By the third week in December most birds had chicks. The breeding time of the Black-browed Mollymawk is thus about two weeks earlier than that of the Grey-headed Mollymawk. The young of the Black-browed species fly about the middle of April; by May 7th all have left.

The following description of the combined breeding colony on Courjolles Point is given by J. H. Sorensen. "My first visit to a mollymawk colony was in the month of October, when thousands upon thousands of these birds had arrived from the sea and begun to occupy the territory they had abandoned some four months previously. The rowdy courtship of birds pairing off, the activities of birds already mated and building their nests, the constant arrival of new members from the sea and departure of others in search of food made a memorable sight.

"The queer mud and straw nests shaped like huge cheeses, are situated about four feet apart—just enough room is left for incoming birds to walk to their own homes without being pecked by the occupants of others. With such intensive settlement the ground becomes heavily fertilised and supports a lush growth of several species of plants. In the late spring, the brilliant green carpet of plants, studded with dark brown nests and occupied by thousands of snowy-plumaged, black-winged birds, is one of the sights of the subantarctic.

"The construction of the nest is done by the building bird gathering mud and straw and trowelling it on with the side of the huge beak. Usually the nests are constructed on earthy ground where plenty of mud and grass is available; but a few unconventional birds build their nests on the tops of huge boulders. The transport of many pounds weight of sloppy mud and grass is quite an achievement.

"Clothed in soft light grey down, with tiny black beaks and bright brown eyes, the mollymawk chicks were admired and loved by all who saw them. Like their parents, they were entirely without fear of mankind and, if one took a little time and gained their confidence, could be handled with ease for weighing and measuring."

By the same observer a colony of Black-browed Mollymawks is thus described: "At North Cape on Campbell Island there is a colony situated in a strange position. Composed entirely of Black-browed Mollymawks, it is seemingly an overflow from the densely populated ledges on the cliffs below. On a small flat at the top of the 800-foot cliffs there is a small tarn and on a low bar and on the large stones in this shallow pond the birds have built their nests. All mud and straw for nest-building has to be carried some distance."

References.—Temminck and Laugier, Planch. Col. Ois., pl. 456, 1828 (*D. melanophris,* Cape Seas). Buller, Birds N.Z., 292, 1873; 2nd ed., 2, 198, 1888. Godman, Monogr. Petrels, 339, col. pl., 1910. Mathews, Birds Austr., 2, 267, 1912 (*T. m. impavida,* Tasmania). Mathews and Iredale, Man. Birds Austr., 1, 50, col. pl., 1921. Murphy, Oceanic Birds S. Amer., 1, 505, 1936. Falla, B.A.N.Z.A.R.E., Ser. B, 2, 122, 1937. Sorensen, Wild Life Subant., 34, 1951.

GENUS DIOMEDEA

Bill with the base of the culminicorn wide and meeting the latericorn on each side behind the nostrils. The latericorn not widening much at the base, the lower angle behind the upper. Tail short and rounded.

Diomedea is readily distinguished by the shape of the latericorn and the absence of a membrane extending back from the nasal tubes. It comes near to Thalassarche, especially Bullers and the Black-browed Mollymawks, but in this genus although the culminicorn widens out behind, there is a space filled by a membrane between the bases of the culminicorn and latericorn, while the latericorn is widened out behind with the lower posterior angle in advance of the upper.

Seven species are included in the genus. They range over the southern oceans and the North Pacific. In the North Atlantic stragglers only have been seen.

Key to New Zealand Species and Subspecies

- General colour brown. .... *D. nigripes*
- General colour white.
  - Upper back with fine transverse lines (vermiculations), fewer in male.
    - Size smaller. Brown on crown and tail. More vermiculations .... *D. ex exulans*
    - Size larger; crown and tail white; fewer vermiculations .... *D. ex. chionoptera*
  - Upper back without fine brown lines.
    - Size larger; male with white patch at carpel flexure *D. ep. epomophora*
    - Size smaller; no white patches on wings ...... *D. ep. sanfordi*

Black-footed Albatross
Diomedea nigripes

This North Pacific albatross is known from south of the equator by two specimens only. One was collected by A. Reischek in Dusky Sound in July 1884. This is in the Vienna Museum and with it is another specimen of this species labelled New Holland.

Adult. Crown dull white slightly mottled with brown; remainder of upper surface dark brown with pale brown edges to the feathers; lower back and rump brown with blackish edges to the feathers; primaries blackish with yellow shafts; upper tail coverts white. Chin white; cheeks, ear coverts and throat pale ashy; remainder of under surface pale ashy grey, the feathers edged with whitish brown, abdomen whiter, under tail coverts white. Bill plumbeous. Iris umber. Feet black. Length 685, bill 107, wing 495, tail 137, tarsus 99, mid toe 127 mm. (North Pacific.) *Immature.* A narrow line of soiled white feathers at the base of the upper mandible, remainder of upper parts deep chocolate brown, lightest on the back of the neck, rump and upper tail coverts; wings and tail like the back, shafts ivory white, blackish towards the tip; chin and throat greyish isabelline, remainder of under parts, including the under wing coverts and axillaries, smoky brown, darkest on the chest and lower abdomen. Bill 96, wing 500, tail 141, tarsus 93 mm. Dusky Sound. (Mathews, 1936.)

Eggs. Clutch one, white or faintly speckled, 108.8 x 70.3 mm.

Distribution. One occurrence. Dusky Sound.

North Pacific Ocean, north of the equator, breeding on the Bonin, Midway and Laysan Islands.

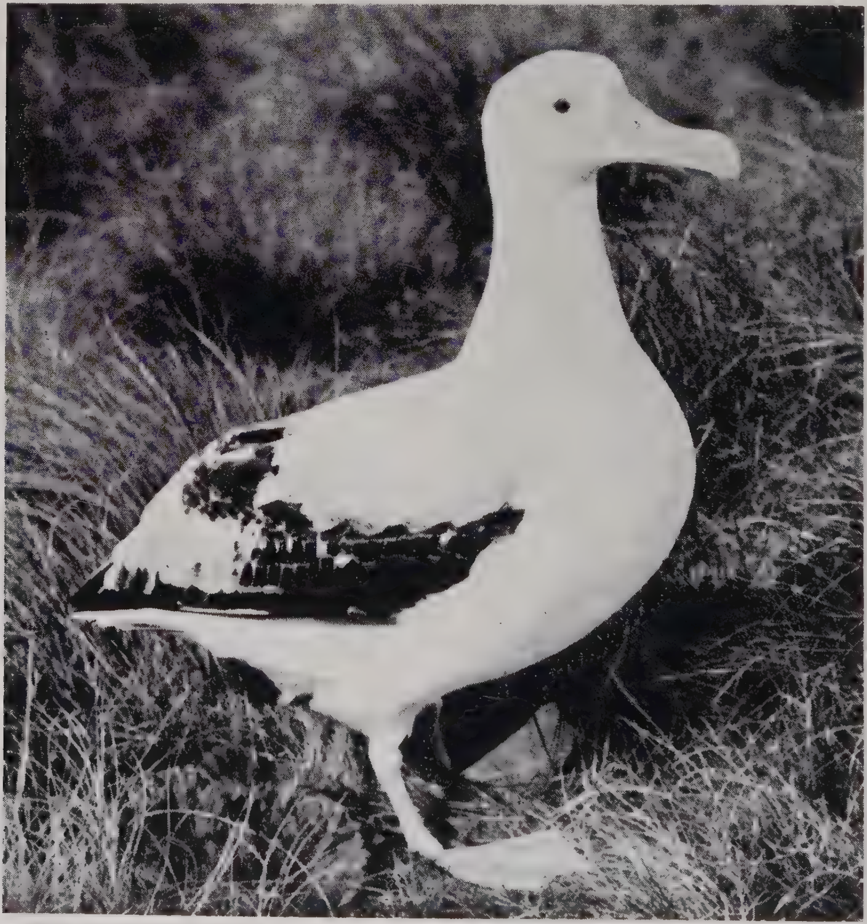
Habits. This species inhabits the North Pacific mainly from the Tropic of Cancer to Behring Strait. It is frequently seen at sea between the Hawaiian Islands and California. The birds sail in circles near the surface. Always when they come to windward they rise steeply. In wheeling sometimes one, sometimes both feet, are spread out, but generally the turn is made without extending the feet. The Black-footed Albatross lays its egg in a hollow scratched in the bare sand. Incubation takes about six weeks and both birds take a share. The breeding season is from September to December.

References.—Audubon, Orn. Biogr., 5, 327, 1839 (*Diomedea nigripes,* Pacific Ocean, lat. 50° N.). Godman, Monogr. Petrels, 332, col. pl., 1909. Mathews, Bull. B.O.C., 51, 29, col. pl., 1930 (*Phoebastria nigripes reischekia,* New Zealand). Mathews, Suppl. Birds Norfolk and Lord Howe Is., 91, 1936.

Wandering Albatross. Toroa
Diomedea exulans exulans

On account of its large size and remarkable power of sailing with motionless wings, the Wandering Albatross was well known to early voyagers. In Shelvocke's *Voyage* (1726) is recorded the incident that Coleridge immortalised in his *Ancient Mariner.* The specific name *exulans* was applied by Linne in 1758 to birds obtained at the Cape of Good Hope. In the New Zealand area the species was first noticed during Cook's first voyage off both the east and the west coasts, and a specimen was shot by Sir Joseph Banks. It was also observed during the second and third voyages and formed the subject of drawings by both Forster and Ellis. The breeding places of the large albatrosses on the southern islands of New Zealand were well known to sealers in the beginning of the nineteenth century, and a hundred years later shepherds were aware of two kinds of large albatross nesting on Campbell Island. These observations, however, did not pass into ornithological literature. The Wandering Albatross was found breeding at the Auckland Islands by the British Antarctic Expedition under Sir James Ross in 1840. At the Antipodes it was found breeding by Captain Fairchild of the Government steamer *Stella* in 1886 or before, and soon afterwards A. Reischek, in 1888, and F. R. Chapman, in 1890, visited the Southern Islands in the *Stella* and published accounts of the breeding places of the birds. A Wandering Albatross was taken at Campbell Island in 1937 and in 1944 R. L. Oliver and L. Pollock found a small colony of seven breeding pairs on Moubray Hill.

Adult male. On the crown a small patch or only a few brown vermiculated feathers. Wings blackish brown; the front margin mottled brown and white; coverts slaty brown, the larger ones edged with white. A large white olecranal patch with fine vermiculations on the wing near the body composed of the inner coverts and secondaries, some of the coverts having vermiculations and subterminal brown patches on the outer webs; tail white with large subterminal black patches. Long scapulars brown with pale tips. remainder of head and body including the under surface of the wings, white, with weak vermiculations on neck, heavy vermiculations on back, upper tail coverts and middle scapulars, and light vermiculations on flanks, breast and under tail coverts. A pink or orange patch is frequently present on the sides of the head. Bill faintly pink, the tip of both mandibles yellowish. Iris dark brown. Eyelids pale purple to bluish white. Feet greyish white. Length about 51 inches; extent of outstretched wings up to 10½ feet, occasionally more. Bill 140-170, wing 585-



Adams Island *J. H. Sorensen*

WANDERING ALBATROSS

Antipodes Island *G. M. Turner*
WANDERING ALBATROSS FLEDGLING

650, tail 170-200, tarsus 105-125, mid toe 150-170 mm. *Adult female.* Usually smaller than the male. Forehead, sides of face and round the eyes, throat and abdomen white. Crown with a brown patch. Nape, neck, breast and under tail coverts white with more or less sparse brown mottling. Scapulars and back with brown mottling and vermiculations. Wings blackish brown with mottled white and brown front edge, and small white olecranal patch near body. Tail feathers black, white towards the base. *Immature, first or juvenal plumage,* both sexes. Forehead, sides of face to above the eyes, chin and throat white. Upper surface dark brown, slightly darker on the crown; feathers of mantle with pale brown margins, wings blackish brown, tail black. Under surface brown, paler on the abdomen, of wings white except the primaries. Iris dark hazel. Eyelids bluish white. Bill flesh pink suffused with bluish. Feet similar to bill, webs bluish grey, toes light horn. *Immature, second plumage,* both sexes. Forehead, sides of face to above eyes, chin and throat white. Crown, hind neck and sides of neck, back and breast brown mottled with white, the feathers being white with broad brown borders. Long scapulars black. Wings and tail brownish black. Middle scapulars, flanks and upper abdomen finely vermiculated brown and white. Lower abdomen white. The *third plumage* in both sexes is as described for the adult female. A fourth plumage is that of the adult male. In the whiteness of the head and the wings this may approach the subspecies *chionoptera*. *Nestling.* Covered with long pale slaty-grey down, lighter on the head and breast. Bill pale pink, the tip yellowish. Feet pale grey. Antipodes Island.

Eggs. Clutch one, elongate ovoid, surface with minute punctures, creamy white with a zone of pale brown speckled smudge at the larger end. 124 x 76, 133 x 76, 123.5 x 82.5 mm. Auckland Island. 129 x 73 mm. Antipodes Island.

Status. The Wandering Albatross differs from the Royal Albatross in the vermiculations, brown on head, black tail and more black on the wings, the shorter bill, and also by their different plumage changes.

The definitions of subspecies of Wandering Albatross and the names to be attached to them have not been definitely settled. Two subspecies are indicated: a smaller kind, *D. e. exulans,* with brown crown, black-tipped tail and a good deal of vermiculation on the body; and a larger kind, *D. e. chionoptera,* which passes through the same plumage stages as *D. e. exulans* and then develops a stage further in which there is no brown on the crown, no black on the tail, black at the

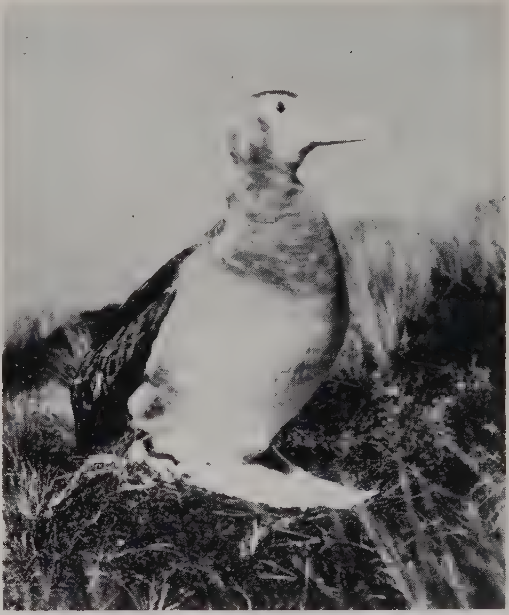
W. P. Mead
WANDERING ALBATROSS, JUVENAL BIRD

tips of the wings only and a very small amount of vermiculation on the body. There is, however, no fixed line of demarkation between these subspecies.

Distribution. Common throughout the whole of the New Zealand seas more especially to the south of the main islands. Breeds at the west end of Adams Land and on Disappointment Island in the Auckland group, Campbell Island and Antipodes Island. It is to be seen off the coast from north of North Cape to Stewart Island, and occasionally enters harbours, it being so recorded in Whangaruru Harbour (during the whaling season), Wellington Harbour and in Dusky Sound. Straggler to Raoul Island.

The southern seas mainly south of 30° S. lat. Occasionally north as far as the Tropic of Capricorn. Breeding on Tristan da Cunha and Gough Island in the Atlantic.

Habitat. The Wandering Albatross has incited the wonder of every voyager in the cold Southern Ocean. It accompanies ships until they enter a region above a certain temperature when it is seen no more. Should a north wind arise when near the northern boundary of its domain then the albatross disappears until cooler conditions obtain. Probably the density of the atmosphere determines whether it can sustain itself above the water. If an albatross be watched closely it will be noticed that a long gradual descent alternates with an abrupt ascent. Obviously its motion is a gliding one, the propelling force being partly the wind striking the under surface of the wings and the bird dexterously manoeuvres so as frequently to get a new impetus. The Wandering Albatross is found in the remotest parts of the ocean. At night it ceases to follow ships, perhaps it rests on the sea, but picks them up again early the following morning. On land it walks rather awkwardly. Its folded wings are held up and its head straight forward. In this manner it makes its way to some sloping ground where it can, facing the wind and running to gain impetus, rise into the air. Sometimes it walks with wings outstretched.



Antipodes Island *G. M. Turner*

WANDERING ALBATROSS, IMMATURE

Food. The food of the Wandering Albatross consists of pelagic cephalopods and other molluscs, crustacea and medusae. In addition to these it regales itself on the refuse from whaling stations and ships. To pick up its food it always settles on the water and swims to it.

Nesting. Antipodes Island lies in such an inhospitable region in a climate characterised by numerous cold storms and foggy days that no forest can exist there. The island is surrounded by cliffs and the general surface is some height above the sea and undulating. This surface, swept by every storm that passes that way, is clothed with vegetation consisting of low and tall tussocks and tufted ferns. In the gullies these plants are as high as one's head and there may be a little dense Coprosma scrub. Scattered among the tussocks of this island the Wandering Albatross makes its nests. They are crater-like structures about three feet across and one foot high, the sides sloping to the summit where the nesting hollow is about one and a half feet across. The material of this miniature volcano-like hill is the surrounding peaty earth with its accompanying vegetable matter, dead fern and grass leaves. The bird scrapes together all within reach and then lines the cup with a little grass. Though so powerful, the Wandering Albatross is quite a gentle bird. Handled gently it allows one even to reach under it to the egg, merely giving a snap or two of the bill.

When I visited Antipodes Island on April 4th, 1927, there were eggs, one of which was hatching, and a chick a few days old. This corresponds with the stage of incubation recorded below for Campbell Island. F. R. Chapman reported eggs on Antipodes Island on February 1st stating that the birds were then just beginning to lay. The incubation period is thus about nine weeks, possibly more. Probably the dates of laying and hatching are spread over some weeks and they may vary from year to year. Fairchild says that they were beginning to lay on Antipodes Island on January 17, 1889, and eggs were just beginning to hatch on March 18th, 1886. From observations made on five nests at South Georgia Rankin concludes that the period of incubation of the Wandering Albatross is not less than 71 days and not more than 73 days.

When the parents return for another nesting season there may still be on the ground some of the previous year's young. On April 4th at Antipodes Island I saw a young bird in its first plumage with large patches of down attached. This fledgling, unless the progeny of a late breeder, was twelve months old. The accompanying illustration, from a photograph by Captain G. M. Turner who was with me at the time, shows this bird.

Antipodes Island *G. M. Turner*
WANDERING ALBATROSS

The courtship of these birds is thus described by Waite who visited Antipodes Island in 1907. "We were witness to many curious antics apparently connected with courtship. Two birds, after rubbing their beaks together, would first lower them almost between the feet and then raise them vertically in the air, a manoeuvre many times repeated. The wings would be outspread to their fullest extent, the male spreading his tail after the manner of a turkey cock. The paroxysm would then subside, to be renewed at intervals. Drops of oil oozed out of the beaks as they were rubbed together. The clapping of beaks with which the performance commenced gave place to a vibratory motion, which seemed to be involuntary, like shivering. The sound was a hollow booming, which gave place to a shriek from both birds, similar to that made by the young when alarmed. This concluded the performance, which was recommenced after a short interval."

On Campbell Island the Wandering Albatross was found breeding by R. L. Oliver and L. Pollock in 1944, the following information being taken from their notes. When discovered on March 17th the birds would have been sitting for about six weeks. On that date two nests each with an egg and a sitting bird were found. On April 6th there were two eggs chipping and there were three chicks. On January 12th the first bird had flown, the others were fledged with some down on head and breast. When visited last, on February 9th, that is, when the birds were ten months old, the other birds had flown, but a fourth chick was still on its nest. Royal Albatrosses were nesting in the same areas as the Wandering Albatrosses. Sorensen, the following year and in the same locality, found an egg of the Wandering Albatross apparently fresh, on February 19th. It is not known for certain how often the Wandering Albatross lays but probably it is at intervals of two years.

On the western end of Adams Island in the Auckland group there is a large colony of Wandering Albatrosses in a very exposed position. Here the birds begin laying about three weeks earlier than they do on Campbell and Antipodes Islands, for eggs were reported by F. R. Chapman to be common on January 5th and incubation had just commenced.

The process of nest building on Adams Island is thus described by F. R. Chapman, who visited the Auckland Islands in January 1890: "When building a nest, the albatross —I suppose the female—scrapes up the mud from about it, but when she has made a little pile she stands upon it, and the rest of the work is done standing thus, so that her weight—from 18lb. to 25lb.—always serves to solidify what has been completed. In working from this standpoint, the bird digs up bits of earth with its beak and lays them upon the pile. About five digs to the minute is the average rate, and when it has done about five it turns and digs from another place. In digging thus it makes a trench round the cone, which may serve to keep the nest drained. It nearly always builds among high tussock but takes little or no pains to conceal the nest. . . . When the nest is built it is finished off with a slight and neatly-made basin-like depression at the top, and in this are placed a few leaves and bits of dry grass, but not enough to prevent the egg from coming into contact with the soil and getting very dirty before it is hatched.

"Many birds which could not fly had a little down hanging about their necks still. Their condition shows that there are many young birds not yet fully fledged when the old birds lay their next year's eggs."

In connection with Chapman's remark that he supposed that it was the female that was building the nest, Dr. L. E. Richdale points out that the male does most of the building of the nest until a day or two before the egg is laid, then the female gets to work.

As with other members of the albatross family, the young are fed by placing their bills across inside the parent's bill and the oily food runs in at the side of the chick's lower mandible. Recent observations indicate that the chicks are fed by their parents until they leave their nesting ground.

Maori. In New Zealand the Wandering Albatross would only occasionally be taken. Its bones were used for making needles and awls and the down was worn as ornaments in the hair and ears by both men and women. The white feathers were used for ornamenting war canoes.

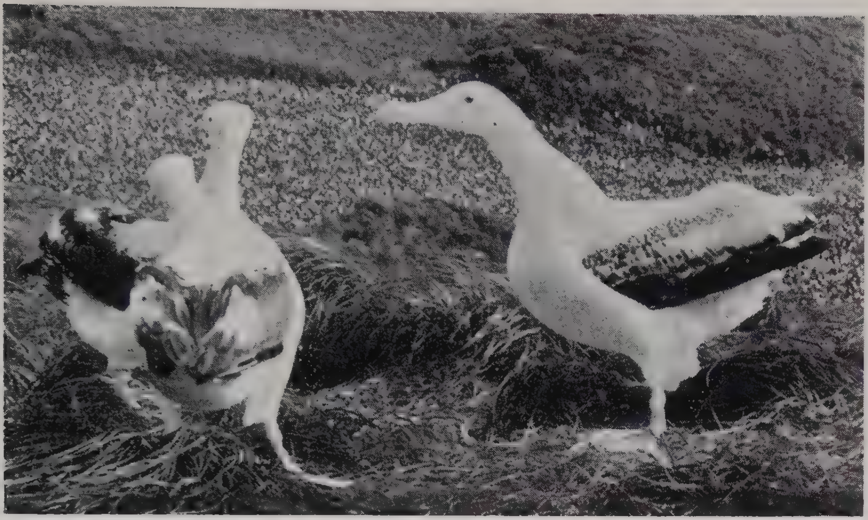
References.—Linne, Syst. Nat., 10th ed., 132, 1758 (*Diomedea exulans,* Cape seas). Buller, Birds N.Z., 289, 1873; 2nd ed., 2, 189, col. pl., 1888; Suppl. 1, 128, 1905. Godman, Monogr. Petrels, 309, col. pl., 1910. Waite, Subant. Is. N.Z., 2, 566, 1909. Murphy, Oceanic Birds S. Amer., 1, 538, 1936 (part). Falla, B.A.N.Z.A.R.E., Ser. B., 2, 114, 1937.

Snowy Albatross

Diomedea exulans chionoptera

The Russian explorer Bellingshausen reported albatrosses as breeding on Macquarie Island in November, 1820. Albatrosses were captured on Macquarie Island in 1911 by the Australasian Antarctic Expedition and recorded as Wandering Albatrosses but no specimens were brought away. In 1951 a breeding colony of Snowy Albatrosses was discovered by the Australian National Antarctic Research Expedition on the south-west end of the island. Photographs taken by the expedition show that the wings were white in the front half to beyond the carpel flexure and therefore in this respect the birds approached the Snowy Albatross.

Adult male. White, except the following parts: scapulars with few vermiculations and subterminal brown patch; wing coverts in back half of wing between body and carpel flexure brown with white margins, between carpel flexure and tip brown; primaries blackish brown except the bases; outer secondaries with blackish brown inner webs.



Macquarie Island *A.N.A.R.E.*

SNOWY ALBATROSS

Bill 156-177, wing 590-680, tail 186-205, tarsus 112-128, mid toe 163-176 mm. Atlantic and Indian Oceans. *Adult female.* White; upper surface behind the neck vermiculated with brown zigzag bars, coarsest on the scapulars; sides of neck, breast and flanks similarly vermiculated; long scapulars with subterminal blackish patch; wing coverts brownish black, those between body and carpel flexure edged with white; a large white olecranal patch formed by the white inner secondaries and the greater and median coverts; primaries and outer secondaries brownish black; tail feathers with black patches on their outer webs. *Immature.* Similar to the immature stages in *D. e. exulans. Nestling.* Covered with white down.

Eggs. 140 x 82, 130 x 78 mm. South Georgia.

Status. The Snowy Albatross differs from the typical Wandering Albatross in the developmental stages of the male advancing further in the whitening of the plumage, the black in the male being practically confined to the wing tips and ends of the quills. Vermiculations are far more restricted and the size of the birds is slightly larger. Macquarie Island birds do not have so much white on the wings as those from the South Atlantic though some have more white, Knightley says only the wing tips are black, than the right hand bird shown in the illustration which in turn has more white than have Antipodes and Auckland Islands birds. There is much more to be found out about the life history of the wandering albatross before the precise status of the snowy albatross can be defined. Maybe it should be considered merely a stage or phase but one which points the way along which the wandering albatross is evolving.

Distribution. Occasionally seen off the New Zealand coast. Breeds on Macquarie Island.

South Atlantic and Indian Oceans, breeding on South Georgia, Marion, Crozet and Kerguelen Islands.

Nesting. A brief account of the breeding colony of the Snowy Albatross on Macquarie Island has been published by R. Knightley. In March, 1951, twelve birds were counted in the colony and there were four nests containing chicks. The nest is described as a mound of mud, feathers and grass apparently made by the birds first trampling a young tussock and then adding to the mound year after year. The nests are situated among tussocks of *Poa foliosa*. An interesting account of the courtship ceremonies is given by Mr. Knightley.

References.—Salvin, Cat. Birds Br. Mus., 25, 443, 1896 (*Diomedea chionoptera*, Kerguelen Is.) Godman, Monogr. Petrels, 322, col. pl., 1909. Murphy, Ocean. Birds S. Amer., 1, 538, 1936 (part). Knightley, Wild Life, 14, 130, 1951.

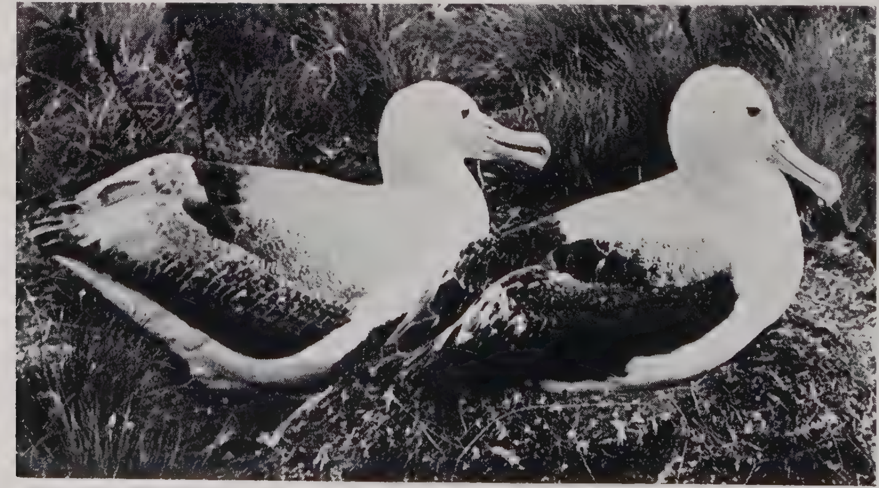
Royal Albatross

Diomedea epomophora epomophora

This magnificent species would be well known to the sealers and whalers who visited Campbell Island during the first third of the nineteenth century. The first specimen to be brought to the notice of ornithologists was taken at sea off the north of New Zealand by Duperry's expedition in 1822. It was described by Lesson in 1825. The Royal Albatross was collected on Enderby Island, in the Auckland group, in 1840, by R. McCormick, one of the surgeons with the *Erebus* and *Terror* expedition, and was found breeding on Campbell Island by the French expedition which called there in 1884. Lesson's account was overlooked for close on a hundred years. In the meantime Buller realised that there were two species of large albatross in New Zealand confused under the name *exulans* and he separated out the Royal Albatross under the name *Diomedea regia* (1891).

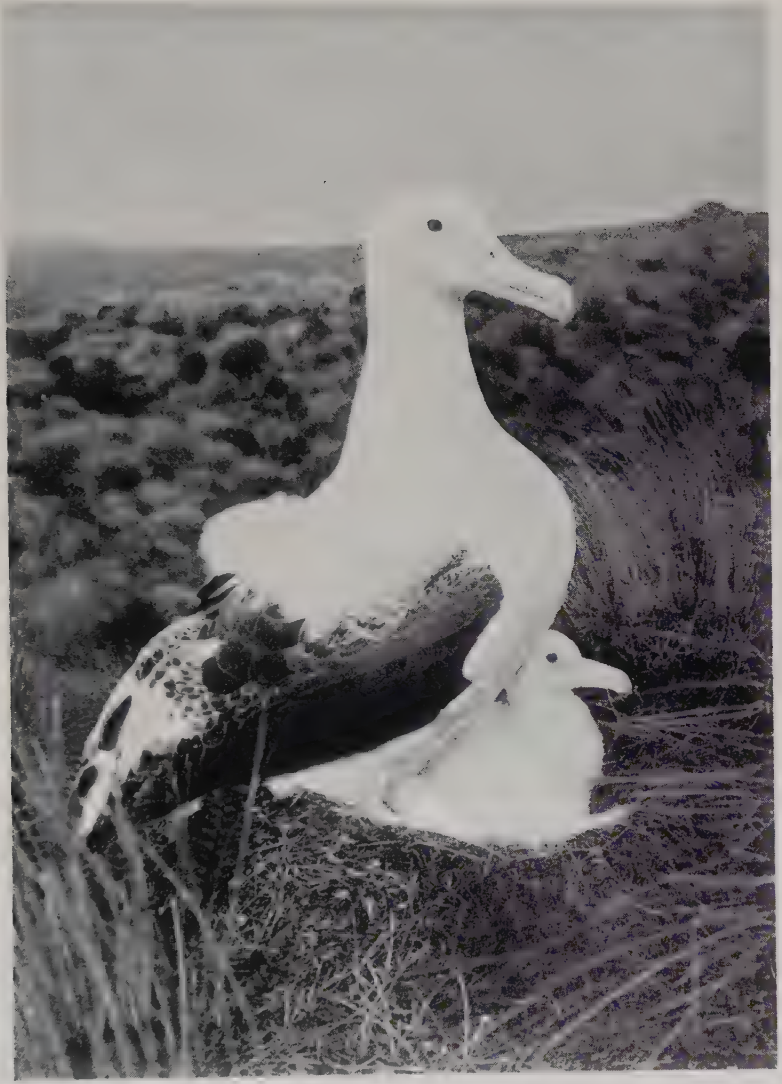
Adult male. General colour white; scapulars with irregular brown crossbars; long scapulars brown margined with white, the bases white; wings black, the coverts varied or margined with white and a large white patch on the humeral flexure; tail feathers white sometimes with black patches near the tips. Bill flesh pink, the hook of both mandibles light horn colour; cutting edges of both mandibles black from nostrils to hook. Iris dark brown. Eyelids black. Feet bluish white, webs bluish grey. Bill 170-186, wing 670-735, tail 190-212, tarsus 120-129, mid toe 165-186 mm. *Adult female.* Smaller; occasionally a few brown feathers on the crown and no white patch on the wing. *Immature.* Similar to the adult but with brown feathers in various parts: a few on the crown, some brown-edged feathers on the backs and flanks; tail white with blackish brown patches and brown zigzag cross bars on the outer webs. Scapulars and wing coverts brown edged with white. *Nestling.* Covered with long white down, shorter on the head. The second down which begins to appear in the third week is a little darker. Bill pale pink, the hook light yellowish horn. Feet bluish white. Eyelid at first white but later turning black.

Eggs. Clutch one, white, without gloss, often with pale pinkish brown blotching in-



Campbell Island *J. H. Sorensen*

ROYAL ALBATROSS, MALE AND FEMALE



Campbell Island *G. M. Turner*

ROYAL ALBATROSS AND CHICK

discriminately over them, this quickly fades and flakes off. 118 x 73.5, 120 x 79, 126 x 78, 131 x 80 mm. Campbell Island. (Sorensen.) An egg from Campbell Island in the Canterbury Museum measures 135.5 x 79.5 mm.

Status. The Royal Albatross comes close to the Wandering Albatross but differs in the longer bill, black eyelids, nasal tubes more inflated, nostrils circular, white head (except females which have a few brown feathers), white tail, and, in *D. e. epomohora,* large white patch on humeral flexure in males. Two subspecies are recognisable, *D. e. epomophora,* white patch on wing near humeral flexure large in male, absent in female; size larger. *D. e. sanfordi,* no white patches on humeral flexure, sexes alike; size smaller.

Distribution. New Zealand seas, breeding on Campbell Island and on Enderby and, according to Bollons, Adams Islands in the Auckland group. A seven months old juvenile Royal Albatross ringed by J. H. Sorensen on Campbell Island 4th October, 1943, was taken the following year at Santiago, Chile.

Seas of temperate South America. Occasional visitor to Australian seas.

Flight. On the day that I landed in North East Inlet, Campbell Island, it was, as is frequently the case in that latitude, blowing a furious gale. With two companions I climbed to the top of the Mount Lyall ridge and in the open valley on the leeward side there was a certain amount of shelter. Here scattered over the landscape were seen the white forms of the Royal Albatross. Near the top of the ridge I watched at close quarters a bird rising to fly. First it deliberately walked up the slope towards the ridge nearing which it started to run, then as it felt the force of the gale, opened its wings and at once rose against the wind and sailed off. No better example could be seen of the method of utilising the power of the wind for the gliding flight of a bird. It would be difficult for the bird to take flight from a flat surface or in a calm. To rise it must have the lifting power of the wind and in this instance it actually sailed off in the teeth of the gale, perhaps not so remarkable a feat in view of the fact that, at the point it departed, namely, the crest of the ridge, there would be a strong upward current of air.

Walking. On land this bird walks exactly in the same manner as its relative the Wandering Albatross, the head being stretched forward in a horizontal position and the wings partly folded and held well up. This is what I saw on Campbell Island when the bird was hurrying through vegetation dripping with moisture. But Sorensen observed the birds walking with head erect as well as with the head low.

Food. The stomachs of young birds from Campbell Island examined by Archey contained fish-bones and the beaks and eyes of cuttlefish. Sorensen observed only fish being fed to chicks in the earlier part of their lives, but a short time before the chicks' departure he obtained evidence of squids having been fed to them.

Nesting. The following information on the breeding habits of the Royal Albatross on Campbell Island is taken from Sorensen's monograph. Sorensen studied the birds through four breeding seasons and made detailed records of their life history.

The males often arrive first and usually

Campbell Island *J. H. Sorensen*

ROYAL ALBATROSS CHICK

construct the first nest although this nest is rarely used, another one for use being constructed later. Mated pairs usually come back to the same locality and always construct a new nest. Breeding takes place every second year. Serious courtship, in contrast to the playing courtship of juveniles, begins in October and pairing takes place in November. Nest construction commences during the same month.

The beginnings of nests are usually only depressions in loose material scooped up by the sitting birds of both sexes. Any clearing away or upbuilding which later takes place gives the drainage so necessary in wet, peaty country. The bird leaves the nest if coarse material is required, but usually sufficient material is at hand for it to reach whilst seated. Although the pressure exerted by the huge webbed feet plays a part in the formation of the basic structure of the nest, the beak is mainly used in nest construction. Straw, mud and other vegetation is hooked into place and wet peat or mud trowelled on with the sides of the mandibles. The pressure of the breast of a seated bird helps to mould the crater in the top of the nest when the bird rotates to gather more material and when pressing that gathered into shape. The nest is erected in a circle of about six feet in diameter, the three foot radius being the limit of the building bird's reach whilst seated on the structure.

In 1942 laying commenced in the last week of November and by the 2nd December about 40 per cent. of the birds had commenced incubation. The eggs begin to incubate as soon as they are laid and the chicks appear almost exactly 79 days afterwards.

For some days before it breaks out of the egg, writes Sorensen, the chick can be heard peeping. In 1943 the first chick heard peeping inside the egg was on 10th February. Most of the chicks are hatched between February 14th and 21st. The guard period for parents covering chicks lasts almost exactly five weeks from the date of hatching, the parents changing at irregular intervals.

Campbell Island *G. M. Turner*
ROYAL ALBATROSS

According to Sorensen secondary down becomes noticeable on the head and lores in the third week. Feathers show through the down about the eighteenth week, only tufts are left at the thirtieth week and all disappears four weeks later. The birds depart during the 36th to 38th week, that is from the second week to the end of October. One did not fly until December 6th. The chicks are fed until a few days before they depart.

Juveniles. The gams or friendly meetings of juvenile birds described by Sorensen are gatherings of three to twelve birds which go through the actions of courtship out of season. Sometimes a mature bird, probably an unmated one, is present and if so usually dominates the proceedings. "At these 'gams' the birds all give the neighing calls usual to courtship. The beak is stretched skywards and the wings outstretched. A variation of this is for the demonstrating bird to half stretch the wings and throw the head rapidly from side to side, making at the same time a loud vibratory call. Usually only one bird at a time demonstrates."

References.—Lesson, Ann. Sci. Nat. (1) 6, 95. 1825 (*Diomedea epomophora,* New Zealand seas). Buller, Trans. N.Z. Inst., 23, 234, 1891 (*D. regia,* Otago Heads); Birds N.Z., 2nd ed., 2, 192, 1888 (*D. exulans* pt., col. pl.); Suppl. 1, 138, 1905. Mathews, Birds Austr., 2, 216, 1912 (*D. e. mccormicki*, Auckland Is.). Godman, Monogr. Petrels, 319, col. pl., 1910. Falla, Rec. Cant. Mus., 4, 213, 1938. Sorensen, Bull 2, Cape Expedn., 1950; Notornis, 6, 25, 1954.

Chatham Island Royal Albatross

Diomedea epomophora sanfordi

The Chatham Island Royal Albatross was for a long time not distinguished from the typical subspecies of the Southern Islands. To a juvenal female of this subspecies taken off the coast of Chile on October 23rd, 1913, Murphy gave the name *sanfordi* and it was later recognised that this bird belonged to the form breeding at the Chatham Islands. A colony which settled at Taiaroa Head, at the entrance to Otago Harbour, has been from 1936 closely studied by L. E. Richdale.

Adult. Differs from *D. e. epomophora* in its smaller size, in the sexes being alike in colouration and the wing being without a white olecranal patch in both sexes. Bill pale purplish slightly mottled with bluish white, tip bluish white; cutting edges of mandibles brown. Iris dark brown. Eyelid black. Feet bluish white, webs suffused with purple, hinder part of tarsus and lower surface of toes more or less purple, claws purplish white. Bill 150-172, wing 590-640, tail 175-204, tarsus 112-124, mid toe 146-170 mm.

Dr. Richdale informs me that among the birds breeding at Taiaroa Head there was a male with dark patches on the head and in several birds dark tips to the tail feathers. *Immature.* Similar to the adult except that the interscapulars have subterminal brown patches, the feathers of the lower back to the base and side of the tail tipped with brown giving a barred pattern, and generally more blackish patches on the tail. Sometimes a few black specks temporarily on the crown. Bill of a lighter pinkish colour than the adult and with the cutting edge of the upper mandible paler brown. Taiaroa Head. *Nestling.* First down white, short, sparse, but soon growing and becoming thick. The second down, also white, begins to appear on the upper back when the chick is about two weeks old. Taiaroa Head.

Eggs. 118 x 77, 125 x 74, 131 x 79 mm. Taiaroa Head.

Distribution. New Zealand seas, breeding

Taiaroa Head *L. E. Richdale*

CHATHAM ISLAND ROYAL ALBATROSS, MALE AND FEMALE

Stewart Island *K. V. Bigwood*

CHATHAM ISLAND ROYAL ALBATROSS

on the Sisters, Forty-fours and Round Island in the Chatham group, and at Taiaroa Head, Otago Peninsula. Stragglers have been washed ashore in Cook Strait.

Seas of temperate South America, probably breeding on Tierra del Fuego.

Nesting. The main breeding colonies of the Chatham Island Royal Albatross are on the outlying islets of the Chatham group. Mr. E. W. Dawson, who visited the Chathams as a member of a Government party bent mostly on dredging, landed on the East Sister on January 29th, 1954, and passed close to the Forty-fours three days later. He informs me that there are about 500 pairs breeding on the East Sister, "nesting on the flat tops in a low scrub of *Cotula renwicki*. They had mainly eggs just hatching and a smaller number of chicks only a few days old." On the West Sister he estimated there were about 750 pairs and on the Forty-fours about 2000 pairs of royal albatrosses.

On the grassy slopes of Taiaroa Head at the entrance to Otago Harbour Royal Albatrosses of this subspecies have attempted to found a colony since 1920 but not until the summer of 1937-1938 was a chick reared. This colony has been the subject of a long and close study by L. E. Richdale and what follows is taken from his publications. The males appear early in October and a few days later some females arrive. It seems that Royal Albatrosses devote at least one season in preparing to get mated and when that end is attained appear to remain mated for life. One male commenced nest building immediately on arrival, October 15th, but the female was not seen until November 8th, although she must have been present unobserved. Next day she laid an egg and the following day the male took charge of it, the female disappearing for a period of six days. Thereafter changes were made at intervals of 14, 10 and 5 or 6 days. In the case of another pair the female built the nest. Incubation takes 78 to 80 days.

According to Richdale the Royal Albatrosses at Taiaroa Head breed each alternate year. The date of laying is a little earlier at Taiaroa Head than it is in the Southern Islands (*D. e. epomophora*). Richdale gives the following range of dates for the Royal Albatrosses at Taiaroa Head: laying October 31st to November 16th; hatching January 20th to February 8th.

The peculiar method by which the nestlings of albatrosses and mollymawks are fed is thus described by Richdale for the Royal Albatross breeding at Taiaroa Head. "The young albatross is fed by both parents upon regurgitated food of a semi-digested nature, and which is transferred from the stomach of the adult bird to its throat by bending down with the tip of the breast almost touching the ground, while the wings are held pointing to the sky. The neck then thickens, due to the occurrence of violent muscular action, which caused the lice to issue forth on to the tips of the feathers. Thus, with much coughing, spluttering, and the appearance of choking, the parent opens its bill ready for feeding; meanwhile the impatient chick is vehemently nibbling at the gape of his food-bearer. At the appropriate moment the chick's bill is not thrust down the throat of the adult in the penguin manner, but is held slightly opened within and across the bill of the parent, the opening of whose throat is reduced to about the size of a penny. The pabulum is then spilled into the infant's upturned mandible, from where it flows down the rapidly vibrating throat into the stomach."

At Taiaroa Head the chicks depart in September with a little down attached and shortly after being fed. They are then seven and a half months old. This period is shorter by about a month than the time that the chicks on Campbell Island stay in the nest.

References.—Murphy, Bull. Am. Mus. Nat. Hist., 37, 861, 1917 (*Diomedea* (*Rhothonia*) *sanfordi,* Chile. Falla, Rec. Cant. Mus., 4, 215, 1938. Fleming, Emu, 38, 391, 1939. Richdale, Emu, 38, 467, 1939; 41, 161, 1942; The Royal Albatross, 1942; Pre-egg Stage in the Albatross Family, 1950; Post-egg Period in Albatrosses, 1952.

ORDER PELECANIFORMES

TOTIPALMATE BIRDS

Bill straight, pointed or hooked at the tip. All four toes united by a web. The obvious character of all four toes being united by a web distinguishes the members of this group from all other birds.

Key to Families

Tail with central feathers greatly produced	*Phaethontidae*
Tail deeply forked	*Fregatidae*
Tail wedge-shaped or rounded.	
Bill hooked.	
Gular pouch very large	*Pelecanidae*
Gular pouch small	*Phalacrocoracidae*
Bill not hooked.	
Bill slender, straight	*Anhingidae*
Bill stout, slightly decurved at tip	*Sulidae*

FAMILY PHAETHONTIDAE

TROPIC BIRDS

Bill pointed; central tail feathers elongated; hind toe very small, connected by a web with the others.

Genus Phaethon

Bill slightly curved throughout, the cutting edges of the mandibles serrated; nostrils distinct, linear. First primary longest. Tail of 12 to 16 feathers, the middle pair greatly elongated and attenuated. Tarsus very short.

Three species found in all tropical and subtropical seas.

Key to New Zealand Species

General colour pinkish white, central tail feathers scarlet	*P. rubricauda*
General colour, including tail feathers, white	*P. lepturus*

References.—Linne, Syst. Nat., ed. X, 134, 1758 (*Phaethon,* type *P. aethurus* L.). Mathews, Austr. Av. Rec., 2, 56, 1913 (*Scaeophaethon,* type *Ph. rubricauda westralis,* Math.).

Western Pacific Red-tailed Tropic Bird. Amokura

Phaethon rubricauda roseotincta

The breeding range of this tropical and subtropical subspecies includes on its southern boundary the Kermadec Islands. It is a straggler only to the North Island of New Zealand. The first specimen to be recorded from New Zealand was shot by Mr. H. Mair from a schooner which was passing the Three Kings in 1877, and although, when recording this bird, Buller stated that almost every year some were washed ashore on the north coast, no other specimen was known to have been found in the New Zealand area for nearly sixty years and the total number of records is only three: off Three Kings 1877, Lake Taupo 1936, and Muriwai 1942. The Taupo bird was taken alive. From the Kermadec Islands the Tropic Bird was first recorded by Cheesemen after his visit to the group in 1887 and specimens were received the following year.

Adult. General colour satiny pinkish white. A lunate black patch in front of the eye extends as a line over the eye and as a broken band behind it; some feathers on flanks and under tail coverts centred with black; scapulars and outer secondaries with black shafts; inner secondaries with black stripe down the centre; tail feathers white with black shafts, long central tail feathers red with black shafts. Bill coral red, brown in nasal groove. Feet black. Bill 62-69, wing 330-345, tail 102-120, central tail feathers 400-430, tarsus

25-30, mid toe 52-57 mm. *Immature.* Upper surface white barred with black; a lunate black patch in front of the eye connected by a line over the eye with a small black patch behind it; primaries and their coverts with the shafts black and a black spot near the tip; two central tail feathers slightly longer than the others and tipped with black. Bill bluish black. Feet bluish white, outerpart of webs and toes black. Raoul Island. *Nestling.* Covered with long whitish down, the top of the head and back tinted with light slate. A black patch in front of the eye. Bill and feet black. Raoul Island.

Eggs. Clutch one, ovoid, variously coloured, most commonly a pinkish colour, marked closely all over with reddish brown spots and blotches. 68.5 x 48.5, 66 x 49, 69 x 47.5 mm. Raoul Island.

Status. Five subspecies have been described. Of these the Western Pacific subspecies (*P. r. roseotincta*) which ranges from North Queensland to the Kermadecs is distinguished from the typical subspecies (*P. r. rubricauda*) of the West Indian Ocean by its deep rose colouration, heavier bill and longer wing. Other subspecies are *P. r. westralis,* Western Australia and Christmas Island; *P. r. melanorhynchus,* Society, Palmerston and Turtle Islands; and *P. r. rothschildi,* Hawaiian and Bonin Islands.

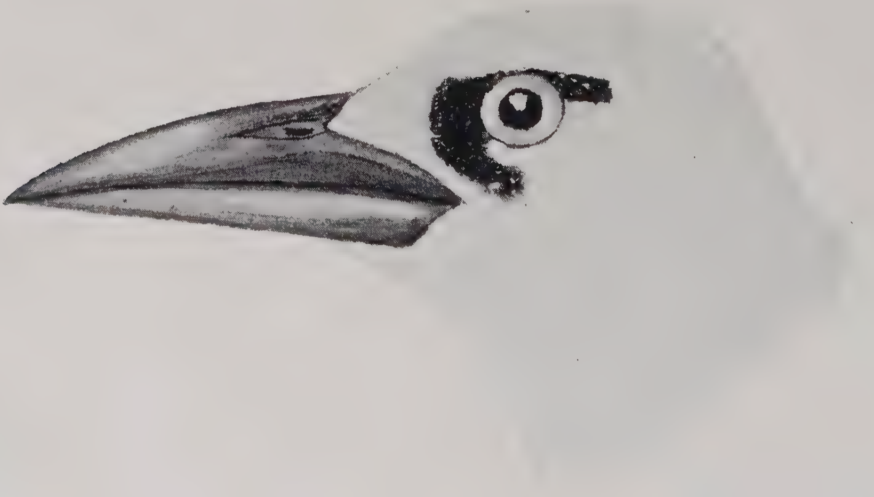
Distribution. Kermadec Islands, breeding on Raoul, Meyer, and Macauley Islands. Straggler to North Island. Three occurrences: off Three Kings, Muriwai, Lake Taupo.

North Queensland to S. Lat. 30°. Breeding on Raine, Lord Howe and Norfolk Islands. Straggler to south-eastern Australia and Tasmania.

Voice. The cry of the Red-tailed Tropic Bird is a very harsh and grating sound uttered two or three times in succession. It is frequently heard when the birds are flying about the islands where they breed, especially in fine weather when they seem to take a delight in showing off their red tail feathers to other members of their kind.

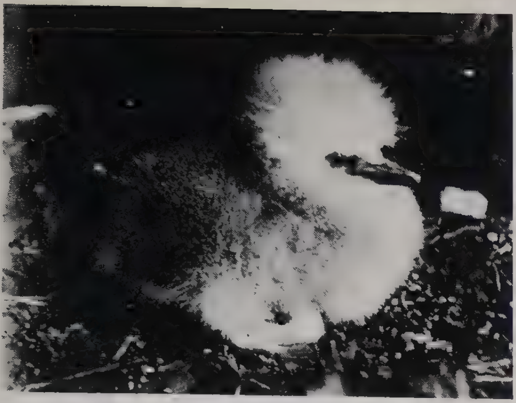
Food. Pelagic fish and squids form the chief food of the Tropic Bird. They are caught by the bird plunging in the water from aloft, sometimes from a height of fifty feet.

Nesting. At Raoul Island Tropic Birds are occasionally seen during the winter months of June, July and August, but for the most part they begin to arrive at the end of October and are plentiful during November when they land and sit about and sleep. The



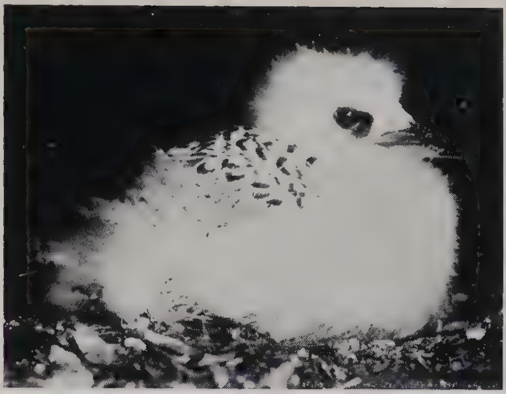
C. McCann

RED-TAILED TROPIC BIRD



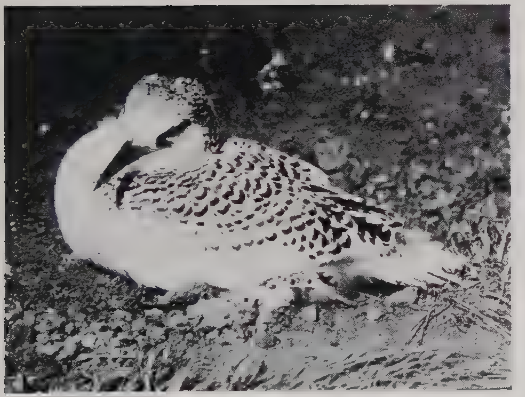
Raoul Island *R. S. Bell*

RED-TAILED TROPIC BIRD, CHICK



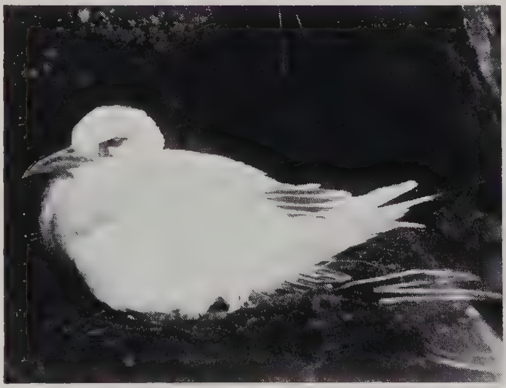
Raoul Island *W. R. B. Oliver*

RED-TAILED TROPIC BIRD, PARTLY FLEDGED



Meyer Island *C. J. Lindsay*

RED-TAILED TROPIC BIRD, IMMATURE



Meyer Island *C. J. Lindsay*

RED-TAILED TROPIC BIRD

nest consists merely of a hollow on a ledge of a sea cliff or of a cliff in the forest a little way from the shore. Often it is in a quite inaccessible place. Most eggs are laid between mid-December and mid-January. The incubation period is 35 days. Occasionally fresh eggs may be found as late as April, and one, probably well incubated, was seen on Meyer Island on May 18th. The young are hatched from mid-January to mid-February and are fully fledged within three months. Most leave the Kermadec Islands during April and early May.

The nestling three or four days old is a very wide awake youngster. When I put my hand near it pecked at it and uttered harsh grating cries. At the age of two and a half months it was fully fledged. It was then a rather vicious and noisy bird with a very harsh cry. Apparently it was fed only once a day. A fledgling found on the beach was taken to camp and fed on fish. A rather large one would be swallowed as far as possible head first, it then gradually disappeared as it became digested. Fully fledged young were noted from March 30th to May 8th. A chick under observation at Denham Bay, Raoul Island, was hatched about February 14th and left the nest on May 8th, that is, when it was 83 days old.

Maori. The Maoris valued greatly for ornamental purposes the long red tail feathers of the Tropic Bird. According to Buller, the natives of the North Cape district systematically searched the coast after easterly gales for these birds. Some of the feathers would be sent to southern tribes in exchange for greenstone.

References.—Boddaert, Tabl. Planch. Enlum., 57, 1783 (*Phaeton rubricauda,* Mauritius). Buller, Birds N.Z., 2nd ed., 2, 186, 1888. Iredale, Emu, 10, 10, 1910. Mathews, Bull. Orn. Club, 46, 60, 1926 (*Scaeophaethon rubricauda roseotincta,* Lord Howe Island).

White-tailed Tropic Bird

Phaethon lepturus

The admission of this species to the New Zealand fauna is based on a sight record made in 1937 at Doubtless Bay by Mr. J. C. Wilkin. One bird was seen on four days, April 18-21, and three were seen on June 3rd. They were all seen at close quarters and a description tallying in every point given with the White-tailed Tropic Bird was sent to me at the time.

Adult. General colour white; a black line in front of and over the eye broadening behind the eye; medium upper wing coverts black; quills with black on outer webs and shafts, the inner quills having only the shafts black; inner secondaries black and white; scapulars white subterminally black; feathers of hinder crown, nape, rump and upper tail coverts white with black bases; tail feathers white with black shafts. Bill red. Iris white. Feet black. Bill 44, wing 280, tail 115, middle tail feathers 380, tarsus 24 mm. *Immature.* General colour white; upper surface barred with black; dark patch above and behind eye; top of head mottled black and white; three outer primaries with black band on outer webs.

Status. The birds that visited New Zealand would doubtless be members of the south-western Pacific subspecies, *P. l. dorotheae.*

Distribution. Doubtless Bay. Four seen. The birds seen by Mr. Wilkin were described as having bright crimson bills and long white central tail feathers so evidently were adult.

All tropical seas. Straggler to Australia and Lord Howe Island. Five subspecies have been defined.

Habits. Mr. Wilkin writes of the bird seen in April: It hovered over the shags' nests in the coastal Pohutukawa trees, apparently attempting to settle among the occupants, but the shags would not tolerate its company, and they were disturbed and constantly on the wing whilst it was about. Its cry, which was somewhat like a long drawn out squeal, unmelodious but not harsh, would completely put to flight all the shags in the vicinity the moment it was uttered, and the stranger would then follow the startled birds along the coast as they fled away in an attempt to get clear of its presence. As they returned the exercise was repeated, and although its efforts to establish amicable relations seemed useless it never seemed to tire of them. Occasionally it would fly out to sea in company with three or four white-fronted terns to join a gathering of sea birds that were following a shoal of fish, returning pretty soon to the rookery, generally in the wake of a homing shag, where it would proceed to disturb the feathered community in the trees again.

Reference.—Daudin, Hist. Nat. Buffon, 14, 319, 1802 (*Phaethon lepturus,* Mauritius).

FAMILY FREGATIDAE
FRIGATE BIRDS

Bill long, both mandibles strongly hooked at the tip. A large gular pouch in the male. Tail long and deeply forked. Web between the toes deeply incised.

The hooked bill, long forked tail and semipalmate toes easily distinguish the Frigate Birds from the other Pelecaniformes.

The family comprises a single genus.

GENUS FREGATA

Characters in addition to those of family value are: Nasal grooves deep, extending to the unguis; wing long and pointed, first primary exceeding the others; tail feathers 12; tarsi short and feathered.

Five species found in all tropical seas.

Key to Species found in New Zealand

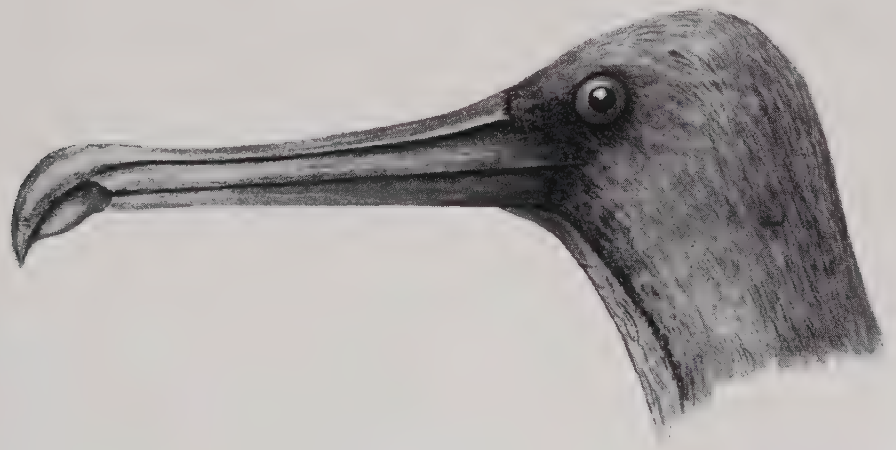
Entirely black	*F. minor* ♂
White patch on each side abdomen	*F. ariel* ♂
Breast and sides white.	
Throat and foreneck greyish white	*F. minor* ♀
Throat and foreneck black	*F. ariel* ♀

References.—Lacepede, Tabl. Ois., 15, 1799 (*Fregata,* type *Pelecanus aquilus* = *P. minor Gmel.*).

Lesser Frigate Bird
Fregata ariel ariel

Only nine times has this species been known to occur in New Zealand, the first record being in 1907 when a specimen was taken at Pahi, Kaipara Harbour.

Adult Male. General plumage black, the head and back with a deep bluish sheen, the under surface with a brownish tinge; a white patch on each side of the body. Bill grey. Gular pouch red. Eyelids black. Feet black. Bill 85.5, wing 545, tail 343, tarsus 16, mid toe 61 mm. Panmure. *Adult female.* General plumage black, the back with a purplish sheen, a chestnut collar on the hind neck, brown patch on upper wing coverts, breast and sides of breast buffy white. Bill bluish. Gular pouch red. Feet red. Eyelids red. Bill 88-92, wing 525-560, tail 315-335, tarsus 17-18, mid toe 57-65 mm. Three New Zealand specimens. *Immature.* Head and breast white mottled with rusty brown.



C. McCann

LESSER FRIGATE BIRD

Back brown. Wing coverts brown, edged with whitish. Wings and tail black. A brown band across the upper abdomen. Lower abdomen white. Under tail coverts black. Days Bay, male. *Nestling.* Hatched naked, later covered with white down.

Eggs. White with a chalky outer layer, 65 x 44 mm. (av.).

Status. Three subspecies are recognised. The examples which straggle to New Zealand belong to the typical subspecies (*F. a. ariel*) which breeds off the coast of Queensland and in the South Pacific.

Distribution. A rare visitor, eight specimens obtained. Pahi, Auckland, Panmure, Little Barrier Island, Te Kuiti, Umutoi, Wellington, Chatham Islands. Reported seen at Nelson, Laingholm and Kaipara Harbour, the last apparently the same bird as picked up on Little Barrier Island.

Tropical western Pacific Ocean, straying north to Japan and south to New Zealand. Other subspecies in the Atlantic and Indian Oceans.

References.—Gould, Birds Austr., 7, pl. 72, 1848 (*Attagen ariel,* Raine Island). Cheeseman, Trans. N.Z. Ins., 40, 265, 1908.

Greater Frigate Bird

Fregata minor palmerstoni

Only eight occurrences have been recorded for New Zealand, the first being an adult male obtained at Wakapuaka in 1861.

Adult Male. General plumage black, a blue green sheen on the head, green gloss on the back; primaries and tail tinged with bluish, inner secondaries and median wing coverts brown; under surface with brownish tinge. Bill slaty grey. Gular pouch red. Eyelids pink. Feet flesh colour. Bill 100-112, wing 560-600, tail 360-413, tarsus 20, mid toe 67-70 mm. *Adult Female.* Head, neck, upper surface, flanks and abdomen black; brown collar on back of neck; inner secondaries and median coverts brownish; throat and foreneck greyish white; breast and sides of body white. Bill rose or bluish. Feet red, light blue, or black. Bill 107. wing 600, tail 410. *Immature.* Passes through several stages. At an early stage red appears on the head and later vanishes. At the flying stage the plumage is blackish brown with the head and neck white with perhaps a few red feathers, upper breast rusty red, abdomen white. Bill and feet bluish. The specimen caught at Castlepoint was brownish black with the head, neck, and fore part of the breast white. Breast fawn, abdomen white; a band of brown from the bend of the wing to the secondaries; primaries and tail black. Bill greyish, horn colour on unguis and black at tip. Feet flesh brown. This specimen was in a phase immediately preceding the adult stage. *Nestling.* Naked when hatched, later covered with white down.

Egg. White with chalky outer layer, 67 x 45 mm.

Status. The male is distinguished from that of the Lesser Frigate Bird by the absence of white, and the female by the throat and foreneck being greyish white instead of black. Immature birds of both species are similar in colour. Subspecies have been defined from all the principal breeding places. The stragglers which reach New Zealand belong to the Pacific form (*F. m. palmerstoni*).

Distribution. A rare visitor, eight occurrences. Lake Kimihia, Castlepoint, Wakapuaka, Cape Farewell, Westport. Reported seen at the Kermadec Islands, Clevedon, Masterton, Tauranga and Whangarei. The last three records probably refer to the same bird.

Western Pacific Ocean. Other subspecies in the east Pacific, in the South Atlantic and in the Indian Oceans.

References.—Gmelin, Syst. Nat., 572, 1788 (*Pelecanus minor,* Christmas Island, Indian Ocean). Buller, Birds N.Z., 339, 342, 1873: 2nd ed., 2, 182, 185, 1888.

FAMILY PHALACROCORACIDAE
SHAGS

Bill strongly hooked at the tip, the lower mandible straight. Gular pouch small. Tail moderately long, wedge-shaped. Tarsus reticulate; outer toe longest, the others decreasing in length regularly.

The distinctive features of the Shags are the hooked bills, wedge-shaped tails, and the triangular web to the toes, with long outer sides.

A cosmopolitan genus of about 25 species.

Key to New Zealand Genera

- Bill stout, higher at base .... *Phalacrocorax*
- Bill slender, of equal width throughout .... *Stictocarbo*

Genus Phalacrocorax

Bill stout, compressed, the upper mandible strongly hooked, the lower slightly curved downwards at the tip. Third quill longest. Usually one or two crests present in the nuptual plumage. Tail feathers 12 to 14.

About thirty species belong to the genus as here defined. They occur in all parts of the world except Polynesia.

Sixteen species and subspecies of shags are found in the New Zealand region. There are two distinct types of bill, stout tapering bills and narrow bills with the upper and lower sides parallel. The first group, *Phalacrocrorax*, contains most of the New Zealand species. The second group, *Stictocarbo,* includes the three species with grey spotted plumage. *Phalacrocorax* can be divided into two natural groups recognisable by the colour of the feet, black or flesh colour. If it is desired to split the genus into two the flesh-footed shags would bear the generic name *Leucocarbo.* The black-footed shags fall into two groups or subgenera, *Phalacrocorax* with long bills, and *Microcarbo* with short bills. In *Leucocarbo* the bills are quite like those of the long billed species of *Phalocrocorax.* This classification is brought out in the following key. In one section of *Leucocarbo* there is a dark form perhaps indicative of the origin of the group from dark coloured species.

Among the blue-eyed shags (Subgenus *Leucocarbo*) the characters of taxonomic importance are the level of the line on the head between the white of the under surface and the dark of the upper surface, and the nature of the caruncles, crest and the white patch on the lower back. Only one species in New Zealand, *P. albiventer,* has the white of the throat reaching as far up the side of the head as the gape. Six species and subspecies have the line of demarkation between white and dark below the level of the base of the lower mandible, and one species is dark above and below.

The young stages of shags that in the adult stage have white under surfaces are more or less brown below. In the subspecies of *campbelli* the foreneck in immature birds is brown. In *varius* and *melanoleucos* the under surface of the young is mottled with brown. It is in keeping with this life history that I suggest that *chalconotus* is near the ancestral form of *huttoni.*

Key to New Zealand Species of Phalacrocorax

- Back black or greenish black. Feet black.
  - Culmen not exceeding 35 mm. (Subgen. *Microcarbo*).
    - Under surface black entirely (juv.) or throat white (adult) .... *P. brevirostris*
    - Under surface white .... *P. melanoleucos*
  - Culmen exceeding 40 mm. (Subgen. *Phalacrocorax*).
    - Entirely black .... *P. sulcirostris*
    - Black above, white below .... *P. varius*
    - Black with white throat and thighs .... *P. carbo*
- Back blue or bluish black (greenish black in *chalconotus*). Feet pinkish. (Subgen. *Leucocarbo*).
  - White of throat reaching to base of lower mandible (under surface black in *chalconotus*)
    - Orange caruncles absent. Young with dark foreneck.
      - Foreneck black .... *P. ca campbelli*
      - Foreneck with narrow white central line .... *P. ca. colensoi*
      - Foreneck with wide white central line .... *P. ca. ranfurlyi*
    - Orange caruncles at base of bill small.
      - Under surface black .... *P. chalconotus*
      - Under surface white .... *P. huttoni*
    - Orange caruncles at base of bill well developed.
      - No head crest. Bill over 60 mm. .... *P. carunculatus*
      - Head crested. Bill under 60 mm. .... *P. onslowi*
  - White of throat reaching level of gape .... *P. albiventer*

References.—Brisson, Orn., 6, 511, 1760 (*Phalacrocorax,* type *P. carbo* L.). Reichenbach, Nat. Syst. Vog., 7, 1853 (*Hypoleucus,* type *P. varius* Gmel.). Bonaparte, Consp. Gen. Av., 2, 176, 1855 (*Leucocarbo,* type *Carbo bougainvillei* Less); Comp. Rend., 43, 577, 1856 (*Microcarbo,* type *P. pygmaea* Pall.). Mathews & Iredale, Ibis, 1913, 415 (*Nesocarbo,* type *Carbo sulcirostris* Brandt.).

White-throated Shag. Kawau-paka

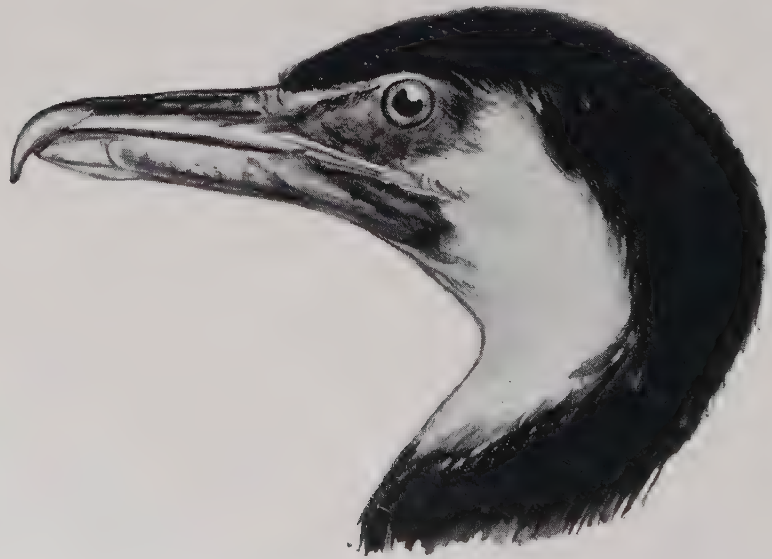
Phalacrocorax brevirostris (semispecies)

The White-throated Shag was first described by the great ornithologist Gould in 1837 from a specimen obtained in New Zealand. It was reported to be common in the Bay of Islands by the naturalists of the American Exploring Expedition in 1840 and the British Expedition under Sir James Ross in 1841. In the Chatham Islands it was first collected by Buller in 1855.

Adult. Sometimes the feathers on the forehead elongated and forming a crest. General plumage glossy black slightly tinged with green on the upper surface; wing coverts and scapulars greyish black margined with jet black; primaries, secondaries and tail feathers black. Sides of face from above the eyes, throat, and foreneck, white. Bill yellow, black on the culmen. Iris dark brown. Bare skin on face greenish yellow. Feet black. Bill 29-32, wing 212-235, tail 143-162, tarsus 35-40, outer toe 62-70 mm. *Immature.* Entirely black; sides of head, foreneck and breast tinged with brown; mantle and upper wing coverts greyish black with brown margins. *Nestling.* Hatched naked and brownish, afterwards covered with black down except the head which remains naked. Small tufts of white along the front edge of the wings. "Bare skin on head pale blue changing to purplish flesh towards the base of the lower mandible" (Buller). Bill and feet black. *Hybrids* between the White-throated and the Little Pied Shags are discussed under the latter species.

Eggs. Clutch three or four, elliptic, pointed at one or both ends, pale bluish with chalky outer layer, 50 x 32, 48 x 30 mm. Tauranga. 55 x 30, 50 x 29 mm. Waiau River.

Status. The status of the White-throated Shag is discussed under the Little Pied Shag but some additional remarks may be made here. The White-throated Shag is far more common than is the Little Pied Shag in New Zealand. Consequently in the main it



Nora Stidolph

WHITE-THROATED SHAG

behaves as a separate species, breeding together and producing like progeny. The Little Pied Shag also, when not mating with the White-throated Shag, behaves as a separate species even while within the White-throated Shag colonies. In Australia, where it is abundant, the Little Pied Shag has no near relative. There may be a tendency towards albinism in the White-throated Shag, as indicated by the variable amount of white on the throat, but the birds with white under surface and white on the wings I would class as albinistic individuals of the Little Pied Shag. These facts should not be lost sight of as lumping in one species would tend to do. I am therefore allowing two species and admitting that crossing is frequent between them, frequent, that is, as regards the Little Pied Shag only.

Distribution. Generally distributed throughout the North, South and Stewart Islands. Found also on some of the outlying islands including Little Barrier Island, Great Barrier Island, Mayor Island and other islands in the Bay of Plenty, and Kapiti. It is found inland as well as on the coast. Straggling to Auckland Islands.

Habitat. The White-throated Shag is found along the coast mostly in estuaries and inlets, but it also occurs on small islands near the shore. It is found on all inland rivers and lakes including streams in the forest at considerable heights on the mountains. It is the commonest species of shag found inland.

Food. The food of the White-throated Shags consists in large part of fresh-water fishes and crustacea. Eels up to six inches in length have been found in their stomachs, also fresh-water crayfish and shrimps. Potts supposes that fresh-water mussels (*Hyridella*) probably form a portion of their food supply.

Nesting. The White-throated Shag breeds in trees usually overhanging the water, on small outlying islets, along the shores of inlets and estuaries and on inland rivers and lakes. It also builds in ravines, in the forest high up on the mountains, and on nigger heads (*Carex*) in inland swamps. Shags usually build their nests in exposed positions and pluck away the leaves and small twigs around them so as to get a clear view while sitting, but Richdale says of this species that in remote parts far from populated areas the interior of trees will be chosen as a site for the nests. Sometimes very large numbers breed together in association with the Little Pied Shag and the Pied Shag. The nests are made of sticks lined with grass and other leaves and are about a foot in diameter. The breeding season extends over a considerable period. Near Tauranga I have collected eggs on December 1st while Richdale found fresh eggs in Stewart Island in January and well-developed chicks in May. Guthrie-Smith states that in Stewart Island

L. E. Richdale

WHITE-THROATED SHAG AND CHICK

C. J. Lindsay

LITTLE PIED SHAG, IMMATURE

the nesting season was practically over in September while Falla reported young flying at Waitangituna River in December.

The reptilian looking naked newly hatched chick very quickly grows a coating of black down. As is usual with shags the young, until they are able to fly, thrust their heads far into the parent's throat to take the food as it is disgorged. The nests are nearly always built over water and the young, when they are old enough to leave the nest, drop into the water. They are by this time able to swim and dive and so easily and quickly reach the shore.

Maori. Buller, writing of the White-throated Shag in 1878 stated: "In the Lake district there are 'shaggeries' of considerable magnitude which are much valued by the natives, each colony of nests having its own proprietor, who exercises all the rights of ownership, visiting the ground at the breeding season for the purpose of collecting the young birds, which are potted in the usual manner and are considered a great dainty. Captain Mair accompanied one of the shag parties to the Tauranga River at Lake Taupo, and saw 400 young birds collected in the course of a single day."

References.—Gould, Proc. Zool. Soc., 1837, p. 26 (*P. brevirostris,* New Zealand). Buller, Birds N.Z., 330, col. pl., 1873; 2nd ed., 2, 168, 1888. Falla, Rec. Auck. Mus., 1, 141 1932. Mathews, Suppl. Birds Norf. Lord Howe Is., 143, 1936.

Little Pied Shag

Phalacrocorax melanoleucos melanoleucos
(semispecies)

The Little Pied Shag is mainly an Australian species which was first described by Vieillot in 1817 from New South Wales specimens. It was collected at the Bay of Islands by the naturalists of the *Erebus* and *Terror* Expedition in 1841, and subsequently has been obtained in various localities usually associating with the White-throated Shag.

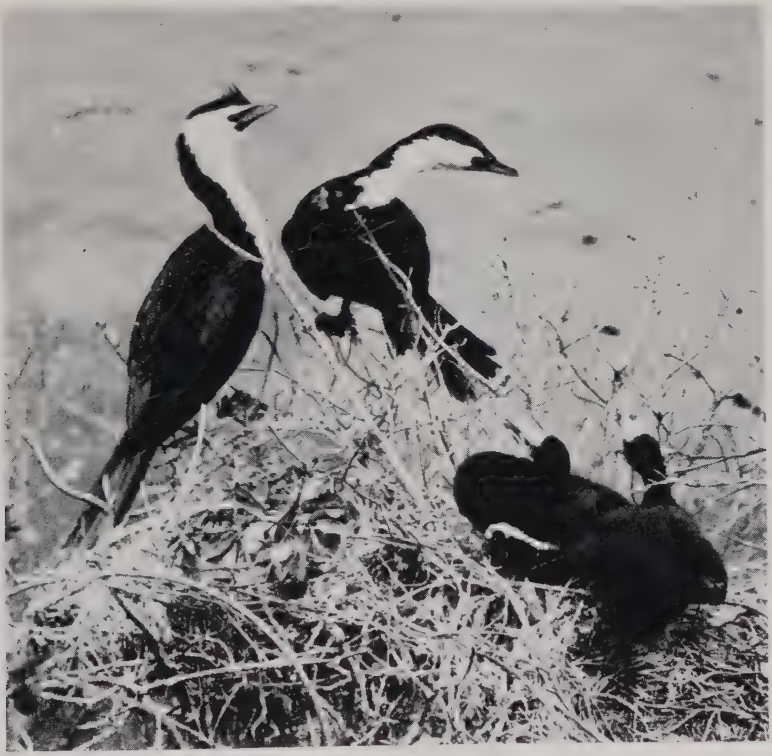
Adult. Upper surface glossy black; wing coverts and scapulars greenish black with jet black edges; primaries, secondaries, and tail feathers black. Face to above the eyes and under surface, including the thighs, white; axillaries, under wing coverts and under tail coverts black. The feathers of the forehead narrow and elongated foming a crest. Bill yellow, the culmen brownish black. Bare skin on face and gular pouch yellow, brownish yellow below the eye. Iris greyish brown. Feet black. Bill 29-32, wing 230-240, tail 145-166, tarsus 35-36, outer toe 62-68 mm. *Immature.* Upper surface to lower edge of eye brownish black, the feathers margined with brown. Under surface white. *Nestling* naked and shining black when first hatched. Later covered with black down, except the face which is bare and whitish with a black line through the eye. Some white spots on the front edge of the wing.

Colour varieties. Partial albinos of the Little Pied Shag are occasionally seen.

Generally most of the white is on the wings. A specimen from Whangarei has been figured by Falla with the remark: "That it belongs to *P. brevirostris* stock, at least in part, is evident from the thin line of black across the breast." But in Australia, where *brevirostris* is not present, a specimen with a black breast band has been taken. The type of *P. finschi,* from the Bay of Islands, which has white patches on the wings, is evidently a colour variety of a similar kind but it has no black on the under surface except the wing and tail coverts. Other similar birds have been observed near Cape Maria van Diemen and at Lake Tarawera.

Hybrids. P. melanoleucos does not normally at any stage in its life history have any black on the undersurface (except the down and the under wing and tail coverts) while *P. brevirostris* has no white on its breast or abdomen at any stage. When, therefore, birds from a mixed breeding colony are found with both black and white on the under surface it is evident that they are hybrids between the two species or semi-species. In the breeding colonies Little Pied Shags are frequently seen mated with White-throated Shags, and thus is explained the birds with intermediate colouring. The hybrids are not infrequent and several have been recorded. There are specimens in the New Zealand museums from Lake Waitakerei, Papaitonga, Aramoho, Takaka and Lake Coleridge. In some the white abdomen has only a few black feathers, in some the abdomen is mottled black and white and in others the middle or even the whole of the abdomen is black.

The record of R. B. Sibson that in Westland the White-throated Shag was common but he saw none of the Little Pied Shag nor any intermediates is significant, for hybrids



L. E. Richdale

LITTLE PIED SHAG AND HYBRID

are not to be expected where only one form is present.

Eggs. Ovoid, pale bluish with chalky outer layer, 49 x 28.5, 51 x 30, 54 x 30.5 mm. Waiau River.

Status. Comparison of specimens of the Little Pied Shag from Australia and New Zealand shows that the two forms are identical. The life history is quite distinct from that of *P. brevirostris.* Both are entirely black, except the bare face, in the downy stage, but the first feathered stage in *melanoleucos* has the under surface white as in the adult. In *brevirostris* the black downy stage is followed by a feathered stage in which the whole under surface is black, while the adult has the chin, throat and sides of face white. These are very different life histories and justify keeping the two forms as distinct species. In nature they behave as separate species which not infrequently cross resulting in birds showing some of the characters of both species.

Phalacrocorax melanoleucos comprises the typical subspecies widely distributed and *P. m. brevicauda,* a smaller form with more white on the head, found on Rennell Island in the Solomon group.

Distribution. Generally distributed throughout the North, South and Stewart Islands both on the coast and inland, not common. Recorded localities include Parenga, Pouto, Thames, Lake Waikare, Ohiwa, Porangahau, Ruamahanga River, Waikanae, Takaka, Wairau, Granity, Waiau, Sumner, Otago Harbour, Lake Gunn, Caswell Sound.

Australia, Tasmania, Java and Celebes eastward to Palau Islands; New Guinea, Solomon Islands, Santa Cruz group and New Caledonia. Accidental in Lord Howe Island.

Nesting. The Little Pied Shag breeds in the same colonies as the White-throated Shag and sometimes with the Pied Shag. Generally there are fewer of the Little Pied Shag than of the other species. Counts of the proportion of Little Pied and White-throated birds have been made and they vary from no pied birds to equal numbers. A flock of 35 Little Pied Shags with no White-throated is on record (Wairau, J. Eyles). The Little Pied Shag usually selects trees overhanging the water in rivers, estuaries and sheltered inlets. The breeding season extends through the winter and spring.

References.—Vieillot, Nouv. Dict. Hist. Nat., 8, 88, 1817 (*Hydrocorax melanoleucos,* New South Wales). Sharpe, Voy. Erebus & Terror, App. 34, 1876 (*Phalacrororax finschi,* Bay of Islands). Falla, Rec. Auck. Mus., 1, 141, 1932. Keast and D'Ombrain, Proc. Roy. Zool. Soc. N.S.W., 1947-48, p. 30. Jones *et. al.* Proc. R.S. Vic., 50, 404, 1938.

Little Black Shag

Phalacrocorax sulcirostris

This species, which appears to be common in only two localities in New Zealand, was collected by Peale of the American Exploring Expedition at the Bay of Islands in 1840. Peale, who got his specimens at Manawaora Bay, stated that it inhabited fresh and brackish water. Not having seen specimens Buller omitted the species altogether in both editions of his work. It was, however, rediscovered by A. T. Pycroft in 1896, when about a hundred birds were seen and seven shot at the mouth of the Waitangi River, Bay of Islands. In 1931 Pycroft discovered the species breeding at Lake Waikare in the Waikato district.

Adult. General plumage brownish black, with a greenish gloss, upper back, scapulars and wing coverts ash, each feather with a wide black margin. In the breeding season white filoplumes scattered over the head and neck. Bill lead colour, culmen black. Iris "emerald green. Gular region and warts on face violet" (Fleming). Feet black. Bill 44-49.5, wing 237-260, tail 118-136, tarsus 38-45, outer toe 73-82 mm. (Falla). *Nestling.* Except the face and crown which are naked, covered with short sooty black down; some white on the carpel flexure. Bill and facial skin purplish grey. Feet black.

Eggs. Clutch two to five, elongate oval, pale bluish with a chalky outer layer, 51.4 x

32.8, 51.7 x 33, 53.2 x 32 mm. Lake Waikare.

Status. There seem to be no significant differences between birds from Australia and New Zealand. The species is distinguished from the young of the White-throated Shag by its larger size and longer and narrower bill.

Distribution. Breeding plentifully at the Bay of Islands and at Lake Waikare in the Lower Waikato district; also islet off Waiheke and Rurima Rocks. Has been observed on Lakes Rotorua and Rotomahana, and on the coast at Parengarenga, Rangaunu, Whangaroa Harbour, Whangarei, Lake Pupuke, Orakei (Auckland Harbour), Piha, Maraetai, Matata, Ohiwa, Tukituki Estuary, Whakatane, Rangitaiki River, and Wellington Harbour. Mr. R. S. Bell informed me that a small number once took up their abode on Raoul Island and remained for a few years.

Australia, Tasmania, New Guinea, New Caledonia, Java, Borneo, Moluccas. Accidental in Lord Howe and Norfolk Islands.

Food. Mr. A. T. Pycroft, who first observed this species in the Bay of Islands, states that these shags are very numerous during the winter months and consume a great quantity of fish, chiefly young mullet. They are seen in flocks, some resting on the surface of the water while others are diving. W. H. Bennett, in 1919, made the following observations on the Little Black Shag at the Bay of Islands: "I often watch them fly about for some time and then settle down in a flock close to the shore. A few minutes later they may be seen skirting the shore at top speed, diving and making a noise in their haste. Members of the flock that get behind will advance in front of the leaders and dive again. The manoeuvres continued for some time." Similar habits of massed fishing have been observed by Fleming on Hakanoa Lake, Waikato district, where the fishes taken are carp and eels.

Nesting. The breeding habits of the Little Black Shag in New Zealand are little known. Reporting on a colony at Lake Waikare 22 March 1936, Fleming says: "Colony on an island in willows overhanging the water. About 200 nests, half occupied. Few with eggs, clutch 2-4. Young in all stages. Downy chicks like the White-throated Shag chicks but with less extensive wing margins. Abundant remains of carp and eels. In January 1937 the colony was about the same size but moved to a new place. Most nests with eggs, clutch 2-5."

References.—Brandt, Bull. Sci. Ac. Imp. St. Pet., 3, 56, 1837 (*Carbo sulcirostris,* N.S.W.). Peale, U.S. Expl. Exped. Birds, 269, 1848 (*C. purpuragula,* Bay of Islands). Buller, Suppl. Birds N.Z., 2, 41, 1905. Falla, Rec. Auck. Mus., 1, 140, 1932.

Pied Shag. Karuhiruhi

Phalacrocorax varius varius

The Pied Shag is found in both Australia and New Zealand but it was first described from New Zealand, the specimens on which Latham based his account having been collected at Queen Charlotte Sound by Forster during Cook's second voyage. Gmelin converted Latham's name of Pied Shag into the specific name "varius." It is probably the Pied Shag that Sir Joseph Banks, who accompanied Cook on his first voyage, refers to in the following paragraph, the locality and date being Mercury Bay, 10th November, 1769. "The water was shoal so we agreed to stop our disquisition here and go ashore and dine. A tree in the neighbourhood on which were many shags' nests and old shags sitting by them confirmed our resolution. An attack was consequently made on the shags and about twenty were soon killed, and as soon broiled and eaten, everyone declaring that they were excellent food, as indeed I think they were." Pied Shags were observed at the Bay of Islands by the American Exploring Expedition under Wilkes in 1840, and the English expedition under Ross in 1841.

Adult. Upper surface, flanks and outer aspect of thighs greenish black, the mantle, scapulars and wing coverts greyish black, each feather bordered with greenish black; primaries, secondaries and tail feathers black. Sides of face and neck, and under surface white, under surface of wings black. Bill dark horn colour, paler at the tip and base of lower mandible. Iris pale green. Bare skin in front of eye, and gular pouch yellow, eyelids deep blue. Feet black. Bill 57-69, wing 274-315, tail 126-156, tarsus 50-60, outer toe 90-104 mm. *Immature.* Above blackish brown with dark edgings to the feathers. Under surface white mottled with brown and blackish brown, the amount of brown varying considerably. *Nestling.* Naked when hatched, the skin black and shiny; afterwards covered with down, dark brown above, paler below. Bill dull yellow, brownish on the culmen. Bare skin on face yellow. Feet black. *Colour variety.* A specimen from Hen Island in the Auckland Museum is pure white except for light brown flanks and thighs and a faint stain of brown on the hind neck, scapulars and rump. Iris dull hazel. Facial skin flesh colour except for yellow patch in front of eye. Feet brown. (Falla.)

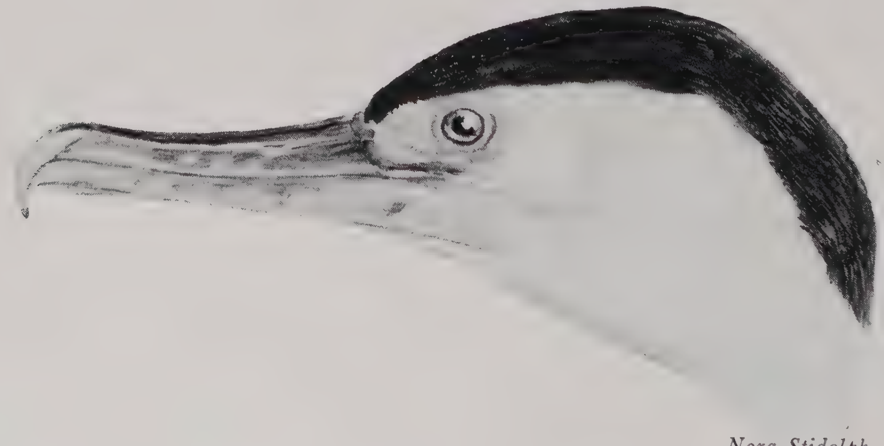
Eggs. Clutch three or four, elliptic, one end slightly more pointed than the other, pale blue, heavily coated with a chalky layer. 57 x 39, 60 x 37.5, 62.5 x 40 mm. (Stead.)

Status. The New Zealand Pied Shag is quite uniform in its characters. It is said to differ from the Australian Pied Shag which has been ranked as a species or two or three subspecies.

Distribution. Three Kings Islands (not breeding). North, South and Stewart Islands; Mokohinau, Hen and Chickens, Little and Great Barrier Islands, and other islands off the Auckland coast, Mayor Island and other islands in the Bay of Plenty, Kapiti. Common from Taranaki and Hawke's Bay northwards. Much less abundant in the South Island where it mostly occurs in Nelson, Marlborough, Fiordland and Stewart Island. Formerly on most of the remainder of the coast but has disappeared through the advance of settlement chiefly by shooting for the mistaken reason that it was harmful to trout. In certain localities such as the Waikato River, and, formerly, Lake Brunner, the Pied Shag occurs a little distance inland.

Southern Australia and Tasmania (*P. v. perthi*).

Ecology. The Pied Shag is mainly a coastal bird, although it is found in estuaries and up rivers for some distance and on fresh water lakes a little way inland. Although it feeds on fish it does very little harm, in fact the only record against it is taking carp in fresh water lakes in the Auckland District. It is mainly a sea-fishing shag and no doubt takes its quota of flounders and other


Nora Stidolph

PIED SHAG

Stewart Island *G. M. Turner*
PIED SHAGS, IMMATURE

edible fish but it has yet to be shown that it does any harm to trout.

The Pied Shag builds in trees along the shore and breaks away leaves and twigs so as to get an unobstructed view. Its colonies are thus very conspicuous and, moreover, the shore is a place much frequented by both Europeans and Maori. It is not surprising therefore that its numbers have been greatly reduced as settlement of the country by Europeans progressed. It maintains its breeding colonies only in situations where it is little disturbed such as unfrequented coasts and islands.

Food. Fishes mostly taken along the sea coast form its principal food. It visits its fishing grounds daily, returning in the evening to roost on the trees in which it was reared.

Nesting. The Pied Shag breeds in colonies in trees along the coast usually actually overhanging the water and often at the top of cliffs. In the two regions where the species is common, namely in the Auckland province and at Stewart Island, the trees which usually overhang the shore are species of Metrosideros, in the north the pohutukawa (*M. excelsa*) and in the south the southern rata (*M. umbellata*) and it is in these trees that the nests of the Pied Shag are most frequently found. The nests are made of sticks, lined with leaves and are fairly large as each year they are repaired by the addition of new sticks so that sometimes if the fork of the tree in which they are placed permits, they may be three or even five feet in height. They are placed in the forks of branches made bare by the shags picking off the leaves and twigs. This habit, which is also indulged in by the Black Shag, is for the purpose of giving the birds a clear view. The Pied Shag often nests in the same trees as some of the other species. Thus in Stewart Island the White-throated Shag and the Little Pied Shag have been found nesting in the same colony as the Pied Shag, while at the Bay of Islands the Black Shag, the White-throated Shag and the Pied Shag breed together. The number of eggs laid by the Pied Shag is generally two or three, but four have been recorded in one nest. They may be found from June to November and the young are ready to fly from September to January.

An interesting account of the feeding of young nestlings of the Pied Shag on Codfish Island, in November 1948, has been published by R. K. Dell. The nest observed was made of branchlets of inanga (*Dracophyllum longifolium*) and placed in a puhere-

E. F. Stead
PIED SHAGS

Little Barrier Island *G. A. Buddle*

PIED SHAG

taiko (*Senecio rotundifolius*) shrub. The parent was covering two small nestlings and an egg. Dell writes: "For about half an hour the adult bird sat tight and then commenced preparations for feeding. The beak was opened and shut rapidly several times. Then, while the beak remained half open, a series of convulsive contractions of the muscles commenced. This culminated in a retching process during which food material appeared to be forced up to the top of the throat. The whole procedure was repeated several times taking in all about a quarter of an hour to complete. The parent bird then moved towards one side of the nest, allowing the two young to emerge from beneath her. Now at the end of the regurgitation process the retching was somewhat prolonged, the head and neck were bent down with beak wide open and the young bird with outstretched neck almost disappeared down the throat of the parent. At the conclusion of each feeding phase the parent shag raised her head and literally shook the young bird out. She then commenced the regurgitation process and proceeded to feed the other chick. Each young bird was fed three or four times before the parent again settled down on the nest. It appeared that the material fed to the young must have been pre-digested for a considerable time."

When young Pied Shags are nearly ready to fly they leave the nests and sit out on the branches.

References.—Gmelin, Syst. Nat., 1, 576, 1789 (*Pelecanus varius,* Queen Charlotte Sound). Buller, Birds N.Z., 328, 1873; 2nd ed., 2, 149, col. pl., 1888. Stead, Life Hist. N.Z. Birds, 12, 1932. Falla, Rec. Auck. Mus., 1, 143, 1932. Buddle, Bird Secrets, 61, 1951.

Black Shag

Phalacrocorax carbo novaehollandiae

The Black Shag was recorded in 1785, in Latham's *General Synopsis of Birds,* as being found in New Zealand. Presumably, therefore, the species was collected during one of Cook's voyages. Grey lists the Black Shag in Dieffenbach's *Travels in New Zealand*, published in 1843.

Adult. General colour above and below shining greenish black; shoulders, scapulars and wing coverts bronzy brown margined with greenish black; primaries, secondaries and tail feathers black. A broad buffy white patch from eye to eye across the throat, extending in a triangular point into the interramal space. Early in the breeding season there are numerous white filoplumes on the head and neck and a white patch on each thigh. There is also at this season a crest or mane consisting of a number of elongated plumes at the back of the head and upper part of the hind neck. Bill brown on culmen and tip shading to horn colour elsewhere. Iris green. Bare skin on face and gular pouch yellow. Feet black. Bill 59-68, wing 340-370, tail 150-165, tarsus 52-62, outer toe 90-104 mm. *Immature.* Upper surface brown with a greenish gloss, greenish black on lower back and rump, mantle and wing coverts coppery brown with darker margins, quills and tail feathers black, sides of head and foreneck dark brown mottled with buff, breast and abdomen yellowish white. Face and gular pouch greenish yellow. Feet black. *Nestling.* Naked when hatched, the skin being dark slaty blue, the top of the head, throat and bill pale pinkish yellow, feet pale horn colour. Later covered with thick sooty black down. Bill: upper mandible dark grey, blackish at tip, lower mandible pale yellow, brownish black at tip. Iris green. Bare skin on face and behind gular pouch grey; gular pouch pale yellow. Feet brownish black, webs pale yellow. *Colour varieties.* Only one albino of this shag has been recorded. The specimen was obtained at Sumner and described by Buller: Upper surface dark cream more or less shaded with brown; sides of head and under surface white; bare skin on face flesh colour; bill black; feet dark brown. Mr. A. C. O'Connor informed me that a cream-coloured Black Shag was observed on several occasions at Martinborough.

E. F. Stead

BLACK SHAG

Eggs. Clutch 3-4, elliptic-ovate, one end a little smaller than the other, pale bluish green, covered with a thin chalky layer which gets rubbed off during incubation. 57.6 x 36.6, 60.5 x 39, 62.5 x 39 mm. Gollans Valley. 64 x 39.5 mm. Rakaia. 61 x 38, 63 x 38.5 mm. Chatham Island.

Status. The New Zealand Black Shag was separated by Mathews and Iredale from the Australian Black Shag on account of its smaller size and "scant white neck feathers of the summer plumage". But the range of measurements overlap so much that size is not a distinguishing character. A point for separation may be found in the extent of white across the throat and face. It may be that this patch is narrower in New Zealand than in Australian birds. If a New Zealand subspecies could be maintained, it would bear the name *steadi.*

Distribution. Generally distributed throughout the North and South Islands, Three Kings Islands, Little Barrier Island, Kapiti, Stewart Island and Chatham Islands. Straggling to Campbell Island. Found inland on lakes and rivers as well as on the coast.

Australia. Tasmania. Possibly northward

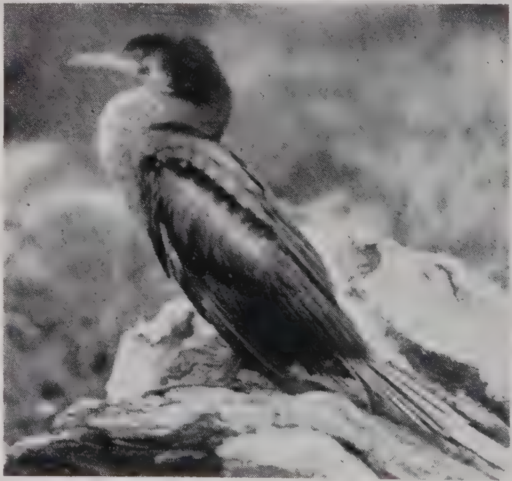
into the Malay Archipelago. Other subspecies are distributed over Europe, Asia, Africa, and the Atlantic coast of North America.

Ecology. Except during the breeding season the Black Shag is usually seen singly, although occasionally, on sand banks in harbours and along the coast, a number may be seen together. Its favourite perch is on a bare branch of a tree or a rock near the water's edge. Everywhere where there is water—the sea coast, estuaries, rivers, lakes and swamps—everywhere indeed where fishes are obtainable, the Black Shag is to be found. After diving for fish it may be seen perched on some rock or branch with its wings outspread drying in the wind or sun.

In the first edition of this work I wrote as follows: "Vilified, condemned, outlawed and with a price on its head the Black Shag stands as the declared enemy of mankind. In the popular view it is a gormandizer that devours unlimited quantities of fish which, if left alone would grow up and afford sport and food for man. The Black Shag's chief crime is that it has transgressed the law that any animal that comes into competition for food with man has no right to live, a crime that is held to deserve nothing less than indiscriminate persecution. Perhaps the worst feature of this is that this wholesale destruction is extended to all species of shags although all but three of the New Zealand ones are harmless marine species. Admittedly the Black Shag takes a large number of fish including trout and perhaps other useful kinds."

This paragraph may stand as a description of popular ideas about the Black Shag and, indeed, shags in general. I said further that the Black Shag does a great deal of good in destroying eels and surplus fish for which it takes its reward in young trout. Support for this statement was given by D. Cairns twelve years after my book was published when, after a lengthy investigation, he said that the eel is a serious predator on trout, and further, as a predator the black shag cannot compare with the eel.

Light on the status of the Black Shag as a destroyer of fish can be gained from the results of two investigations recently published. Falla and Stokell carefully analysed the stomachs of 62 birds from five localities. Their report shows that 36 trout were taken from 20 birds and 29 eels from 15 other birds. The conclusion from these figures is that the shags take the kind of fish that is locally abundant. The work carried out by H. G. Williams has been mainly the counting of trout and eels from the stomachs of Black Shags. His investigations were made in Otago and Southland over a period of twenty-five years. He records a total of 2883 stomachs examined in which were found 15,805 trout and 18 eels. The habitats of the birds killed were mainly rivers where obviously trout were predominant over eels. However, the facts obtained are not to be disputed, unless it be questioned that some of the fishes included as trout were really small native kinds, and they show that the Black Shag consumes vast numbers of young trout and so must be accounted a menace to the edible fish of our rivers. The trout-eel-shag relation, however, is not solved by these investigations. They do not cover a sufficiently



Kapiti Island *A. S. Wilkinson*

BLACK SHAG, IMMATURE

wide range of habitats or country to assess the true interrelations of these animals as regards their food. There is no evidence to show what effect, direct or indirect, shags have on trout in eel-infested waters.

Food. Fish of all kinds and crustacea form the food of the Black Shag. In the sea it takes the herring and other small fishes. In estuaries flounders are added and in rivers, eels and trout are the principal species taken. Supplied with a throat capable of great distension and with powerful digestive juices the Black Shag is able to cope with quite large fishes. Eels eighteen, twenty and even up to twenty-seven inches in length have been found in the stomach and throat of the Black Shag, for a large fish does not disappear into the stomach all at once but gradually goes down as it gets digested. Besides fish, the remains of insects and crustacea are generally found in the stomachs of shags, but Williams thinks that the caddis fly larvae are really taken in the stomachs of the fishes that the shag swallows, and he demonstrated that this actually was the case in several shags he examined.

The following vivid account of a Black Shag catching and swallowing a large fish is taken from H. G. Williams' little book *The Shag Menace*. "After swimming for a minute or two it dived and came up with what appeared to be a large trout in its beak. It lashed the fish about on the surface of the water for about five minutes, evidently trying to kill it. The Shag then made several unsuccessful attempts to fly away with the fish, the weight evidently being too great. The bird then adopted the usual practice of lying flat on the water with its neck outstretched and continually working the fish about until it was in the head-on position for swallowing. This operation occupied about five minutes and the Shag came upright again with five or six inches of trout protruding from its mouth. A few minutes later the Shag rose from the water and settled on a dead branch of a tree on the lagoon bank." About 45 minutes afterwards the Shag was shot and it was found that the trout was in an advanced state of decomposition. It was estimated that about 1 lb. 4 oz. had been digested to a varying degree within that period. The Black Shag always swallows fishes head first. There can, however, be an exception to this rule as the following account by T. M. Roberts of Clevedon testifies. "A shag came to the surface with a large eel, estimated at 2 feet 6 inches. The shag thrashed the eel on the water. The eel repeatedly twisted round the shag, which then released it, dived again, got a fresh grip, and surfaced and thrashed again and again. Finally the shag swallowed the eel, tail first, and flew heavily away with the eel's head projecting from its beak about 3 inches."

Nesting. The Black Shag breeds in colonies sometimes associated with the Pied Shag and the White-throated Shag. Usually its nests are placed in trees overhanging a river or lake, or on cliffs either on the coast or inland. Trees in other situations, such as the edge of the forest are also used or the nests may simply be placed on flax bushes (Phormium) or nigger heads (Carex) or even on the ground. Swamps near the sea coast were not uncommon breeding places, the nests being placed on the tops of nigger heads. No attempt is made to hide the nests; on the contrary the shags when building on trees always pick off the leaves and twigs about their nests and resting places

E. F. Stead

BLACK SHAG CHICK

so as to get an unobstructed view. Sometimes a single nesting pair is seen, but more usually nests are found in colonies sometimes up to 100 birds. The nests are large structures, firmly built, of large sticks. On this foundation is a platform of fine sticks and roots including green twigs that the shags have plucked from around their nests. The egg hollow is lined with cabbage tree leaves, grass, raupo and other water weeds, bark and other fine plant material that is at hand. A nest in beech trees at Gollans Valley measured 22 inches across, the egg hollow being 12 inches across and two deep. Old nests are often used again after adding more building material. In this way a nest a yard or more high may be constructed. It is said that the Black Shag not only returns to the same nest each year but if the nest is vacated through the death of the owners it is not utilised by any other birds. Three or four eggs are laid and apparently two broods are reared in a year, one about May and June and another two or three months later.

In Otago Williams records a pair of Black Shags as laying early in September. Incubation took three weeks. In Gollans Valley young birds judged to be three weeks old were collected on June 3rd so the eggs must have been laid the last week in April. But eggs are laid over a long period in each of the breeding seasons if indeed separate breeding seasons can be defined.

The nestlings of Black Shags are fed by both parents on small fishes and crustacea, the feeding process consisting of the young placing its head within the mouth of the parent which thereupon regurgitates the food into it. At first the food will be thoroughly digested, later partly digested food is given the young and when they are ready to fly, usually at the age of six weeks, whole fishes are disgorged. According to the observations of E. F. Stead the food of young shags in districts where eels are to be obtained is mainly this fish.

"The young of Black Shags when hatched are naked," says Stead, "and have an exceedingly reptilian appearance, their thin wrinkled skin being many sizes too big for their bodies, and so loose that pulling it at the tail-end will tighten it right over the head. . . . In about a fortnight the young bird begins to grow a thick coat of dark smoky-black down, but the face from behind the eye is bare. . . . If a person climbs up to their nest from below, their first line of defence is to disgorge the contents of their crops at him—a considerable volume of half-digested fish, possessed of a penetrating and almost ineradicable odour—and if their aim has been good, this usually has a definitely discouraging effect on the intruder; but if he persists, they will forsake their nest on his approach, crawling out along the branches and balancing themselves in a manner that would have seemed impossible in such apparently flaccid creatures. Their very flaccidity is indeed a great help to them, for they sag down on all sides of their support and so lower their centre of gravity, enabling them to remain poised on thin bare branches." If the branch is shaken the bird may drop its wings down so as to act as pendulums.

References.—Linne, Syst. Nat., 10th ed., 133, 1758 (*Pelecanus carbo,* Sweden). Stephens, Shaw's Gen. Zool., 12, 93, 1826 (*Phalacrocorax novae hollandiae,* Tasmania). Buller, Birds N.Z., 325, 1873; 2nd ed., 2, 145, 1888. Stead, Emu, 8, 71, 1908. Mathews and Iredale, Ibis, 1913, 411 (*Carbo carbo steadi,* New Zealand). Stead, Life Histories N.Z. Birds, 1, 1932. Falla, Rec. Auck. Mus., 1, 139, 1932. Williams, The Shag Menace, 1945. Falla and Stokell, Trans. Roy. Soc. N.Z., 74, 320, 1945. Buddle, Bird Secrets, 64, 1951.

Campbell Island Shag

Phalacrocorax campbelli campbelli

The Campbell Island Shag, readily recognised by its black neck, was first collected by Dr. Filhol, naturalist to the French expedition which visited Campbell Island in 1874 for the purpose of observing the transit of Venus. Filhol's account of the species was not published until 1878. In the meantime, E. Jennings of the Canterbury Museum visited Campbell Island in H.M.S. *Nymphe* and collected some shags of this species. These were placed on record by Hutton who identified them with a South American species.

Adult. Head crested. Upper surface bluish black, greenish on neck, mantle, scapulars and wing coverts; quills and tail feathers black; a white alar bar but no white dorsal patch. Chin and throat white; foreneck bluish black like the hindneck; remainder of under surface white. Bill dark brown, passing into orange at base. Ring round eye purple; bare skin on face brown with small orange spots; gular pouch arterial red. Iris dark brown. Feet flesh colour, joints and soles black. Bill 48-56, wing 267-293, tail 114-128, tarsus 52-65, outer toe 94-110 mm. *Immature.* No crest. Upper surface and thighs dark brown, glossed with green; foreneck dark brown; wing coverts and tail feathers dull brown with pale margins. Under surface except the foreneck white. No white alar bar or dorsal patch. Face dark brown. Gular pouch flesh colour. Feet brownish flesh colour.

Eggs. Clutch three, elliptical, greenish covered with a chalky coating. 58-63 by 35-41 mm.

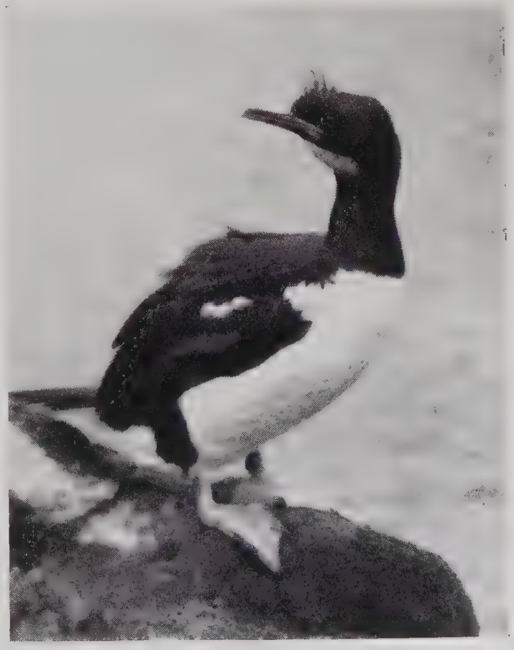
Status. The shags from the Campbell, Auckland and Bounty Islands are associated together as subspecies of one species on account of their general agreement in colour and especially in the foreneck being dark in the immature stage. In this last character they differ from all the other New Zealand species of *Leucocarbo* except *chalconotus.* In the adults there is a gradation from the black neck of *campbelli,* to a narrow white strip down the centre in *colensoi,* and a wide strip in *ranfurlyi.* In these characters, however, the difference between *campbelli* and *colensoi* is not clearly marked. *P. c. campbelli* and *P. c. colensoi,* about equal in size, are the smallest members of *Leucocarbo* in New Zealand.

Distribution. Campbell Island, common. Antipodes Island, one specimen.

Habits. Like its relative at the Auckland Islands, the Campbell Island Shag is sedentary in its habits. It is commonly seen sitting in groups on the rocks by the water's edge, and, as is also the case with the Auckland Island Shag, there are usually one or more Red-billed Gulls in attendance.

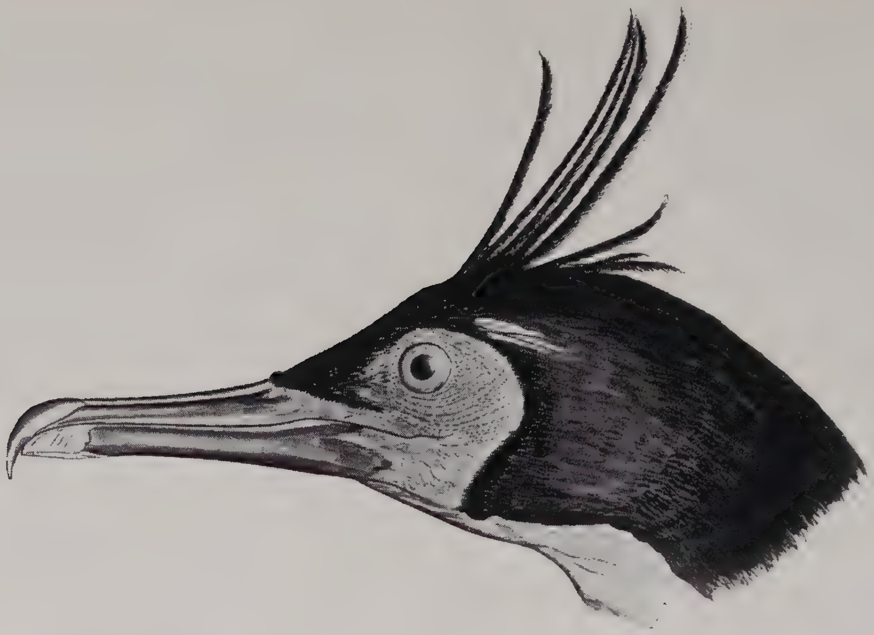
Several breeding colonies of shags were located by J. H. Sorensen on Campbell Island. All were situated on ledges of cliffs facing the sea and all were quite inaccessible. Observations could only be made through field glasses. On the slopes of Mount Pusieux overlooking Monument Harbour nests were placed on the ledges in a single row well back against the cliff face. Only in a few places where the ledge widened would there be a double row. In this locality on January 24th well grown chicks were seen. Nests seen on the north coast were loosely built structures of tussock grass. "The bird trampled the material into position standing on the rim and hollowed out the centre with its beak."

References.—Filhol Bull. Soc. Philom., 2, 132, 1878 (*Urile campbelli,* Campbell Id.). Hutton, Trans. N.Z. Inst., 11, 338, 1879. Buller, Birds N.Z., 2nd ed., 2, 167, 1888. Mathews, Suppl. Birds, Norf. Lord Howe Is. 135, 1936.



Campbell Island *J. H. Sorensen*

CAMPBELL ISLAND SHAG



B. Osborne

AUCKLAND ISLAND SHAG

Auckland Island Shag

Phalacrocorax campbelli colensoi

Although this shag is abundant at the Auckland Islands it was not collected by the English, American or French expeditions that called there about 1840. The first specimens obtained appear to be those collected by Mr. Burton of the Colonial Museum in 1885. More than twenty were brought back from the Auckland Islands, and of these, Buller received two. On these he founded the species *colensoi* in the second edition of his *Birds of New Zealand*, dedicating it to the Rev. William Colenso who contributed much to the literature of New Zealand botany and ethnology.

Adult. Similar to *P. c. campbelli* but generally the white on the foreneck extends as a narrow band from the throat to the upper abdomen. There are, however, a good many birds where the bluish black of the hindneck is joined across the foreneck but for a shorter distance than is usual in the Campbell Island Shag. Very rarely there is a small white dorsal patch. The white on the throat, wings and back increases with age but the order of appearance differs in different individuals. The white alar bar may appear before the black band across the foreneck disappears or afterwards. The white dorsal patch, when present, appears last. A crest is present in the breeding season. According to Sorensen the eye ring is pinkish and the facial skin lemon to golden yellow, that is, lighter than in *P. c. campbelli.* Bill 48-54, wing 260-285, tail 118-125, tarsus 60-62, outer toe 108 mm. *Immature.* Upper surface brown glossed with green, rump and thighs darker. Under surface white except for a brown band across the foreneck. This band is narrower than in the immature of *P. c. campbelli.* Bare skin on face brown. *Nestling.* Covered with brownish black down with white on the breast and abdomen.

Eggs. Clutch two, ovoid, pale bluish with smooth outer chalky layer, 60 x 39, 57 x 36.5 mm.

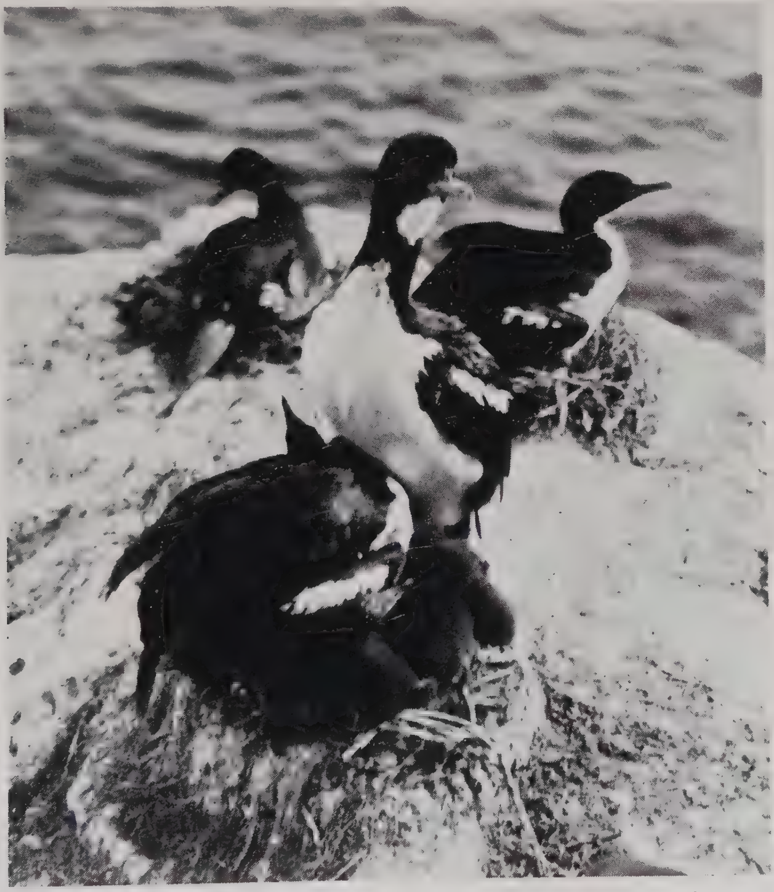
Status. Co-specific with *P. c. campbelli,* in the main differing in the presence of a narrow band of white from throat to upper abdomen, but there are birds with the neck dark all round as in *campbelli* though of lesser extent. Thus the tendency in the Auckland Island Shag for a central white band to develop on the foreneck does not always go the whole way to dividing the black band round the neck.

Distribution. Auckland Islands, where it occurs in immense numbers.

Habits. The Auckland Island Shag is evidently a sedentary species, remaining near its breeding place. It is generally to be seen sitting about the rocks along the shore in the inlets or at sea nearby fishing.

Food. Waite, who visited the Auckland Islands with the scientific expedition in 1907, records seeing the off shore waters black in patches with shags evidently feeding, their food being scattered over wide areas but closely packed where it occurred. Later some birds were dissected and it was found that their stomachs were crowded with the small crustacean *Munida subrugosa.* One contained small bones of fish in addition. On a later visit to Auckland Island pilchards were identified in the stomachs of the shags.

Nesting. Nests were found by Stead on sea cliffs on Enderby Island on February 2nd. Some contained eggs, others half-grown young. The nests were built of seaweed, the outside being heavily encrusted with the



Auckland Island *J. H. Sorensen*

AUCKLAND ISLAND SHAGS

droppings of the birds. The shag colony at Cape Crozier was visited by J. H. Sorensen on 4th February, 1944. He found nests that had not yet been used, nests with eggs and nests with chicks in all stages of growth from newly hatched to almost fully fledged, and concluded that the nesting season must be a protracted one. Many shag nesting colonies on Auckland Island have been destroyed by wild pigs.

References.—Buller, Birds N.Z., 2nd ed., 2, 161, 1888 (*P. colensoi,* Auckland Islands); Suppl. 2, 28, 1905; Ibis, 1895, 39. Waite, Subant. Is. N.Z., 2, 581, 1909. Mathews, Suppl. Birds Norf. Lord Howe Is., 135, 1936.

Bounty Island Shag

Phalacrocorax campbelli ranfurlyi

This subspecies which is confined to the Bounty Islands, a small group of granite rocks without any land vegetation whatever, was collected by the Earl of Ranfurly, Governor of New Zealand, in 1901. Lord Ranfurly visited all the outlying islands of New Zealand and made extensive collections of birds' skins all of which were forwarded to the British Museum.

Adult. A well developed upright crest present in the breeding season. Upper surface and thighs bluish black; crown, wings and interscapular region greenish black; quills and tail feathers black. A white alar bar but no dorsal white patch (the type specimen has two white feathers on the back). Under surface white. Bill pale brown, darker on the culmen. Iris brown. Ring round eye purple, bare skin on face scarlet with black spots, gular pouch scarlet merging into orange near the bill. Feet light flesh colour. Bill 52-60, wing 282-292, tail 135, tarsus 60-65, outer toe 110-117 mm. *Immature.* Brown, blackish on the back, wings and tail; the brown extends across the front of the neck in a variegated band. Chin, throat, and under surface white. No white wing bar. Bill pale brown. Iris pale brown. Bare skin on face brown, gular pouch grey. Feet brownish flesh colour.

Status. The Bounty Island Shag agrees with *P. c. campbelli* and *P. c. colensoi* in the young having a dark foreneck. In the absence of a dorsal white patch it agrees with *campbelli* and differs from *colensoi.* It differs from both *campbelli* and *colensoi* in its large size and wide white stripe down the foreneck. It is close to *P. huttoni* but differs in having no white dorsal patch and in the young having a dark foreneck. The bare skin on the face, other than the blue eye-ring, is described as dark brown in *huttoni* and scarlet in *ranfurlyi,* but face colours should be used with caution as the colour alters in different seasons.

Distribution. Bounty Island, where it is not common. Shags seen at Antipodes Island may belong to this subspecies.

Habits. The Bounty Island Shag is apparently a sedentary species, remaining near the islands all the year round. Small numbers are to be seen on the rocks or swimming in the water nearby and fishing. The whole group of rocks forming the Bounties is not very extensive and there cannot be many individuals of the shag altogether.

Food. A shag was noticed during my visit to the Bounties with a small red fish like a Scopaena which it had just caught quite close to the rocks, but its principal food is small pelagic crustacea.

Nesting. The nesting habits of this species were observed by the members of the *Alert* expedition which visited the Bounties in November, 1950. The shags were found breeding on narrow ledges on the sea cliffs. The nests were well made of bryozoa, polyzia and seaweeds. The eggs were fresh, but not more than one was found in a nest on this date. The birds were in full breeding plumage with well developed erect crests, scarlet face and gular pouch, and pink feet.

References.—Ogilvie-Grant, Bull, Br. Orn. Club., 11, 66, 1901 (*P. ranfurlyi,* Bounty Id.); Ibis, 1905, p. 571. Mathews, Suppl. Birds Norf., Lord Howe Is., 135, 1936.

Bronze Shag

Phalacrocorax chalconotus (semispecies)

The Bronze Shag was first collected in Otago by Mr. Percy Earl who forwarded a specimen to the British Museum. This example was described by Gray in the report

Kane-te-toe *H. Guthrie-Smith*

BRONZE SHAG

on the birds of the *Erebus* and *Terror* expedition. Another specimen, collected in Otago about the same time, was described in the report of the birds of the French expedition under Admiral d'Urville. Hutton was apparently the first to question the status of this species. As early as 1903 he noticed that the colours of the skin on the face and gular pouch were exactly like those of *P. stewarti* and stated his belief that it was a black descendant of that species. Guthrie-Smith actually observed and photographed the two forms mated on the island of Kane-te-toe some time before 1911.

Adult. Head crested. General plumage black, glossed with metallic bluish green; crown greenish black; mantle and upper surface of wings black glossed with oil-green; primaries and tail feathers brownish black. White breeding plumes near the eyes. "Bill light grey, dark grey on the culmen. Iris pale brown. A line of minute red papillae along the forehead on either side. Ring round eye bright cobalt; bare skin on face purplish black; angle of mouth and gular pouch orange red. Feet fleshy white, soles and claws black." (Buller.) Bill 53-69, wing 275-311, tail 120-142, tarsus 54-64, outer toe 98-118 mm. *Immature.* General colour brown; crown, breast and upper back glossed with oil-green, the feathers with dark margins; lower back, rump and upper tail coverts glossed with dark bluish green. *Nestling.* Hatched naked, black; soon covered with long, thick, sooty brown down. Bill dark brown, yellowish on the lower mandible. Sides of face and chin bare, dark coloured; a spot of orange on each side at the angle of the mouth. *Hybrids.* Several specimens of Bronze Shags have been obtained with scattered white feathers on the under surface. This tendency to whiteness is presumed to be due to crossing with the Stewart Island Shag.

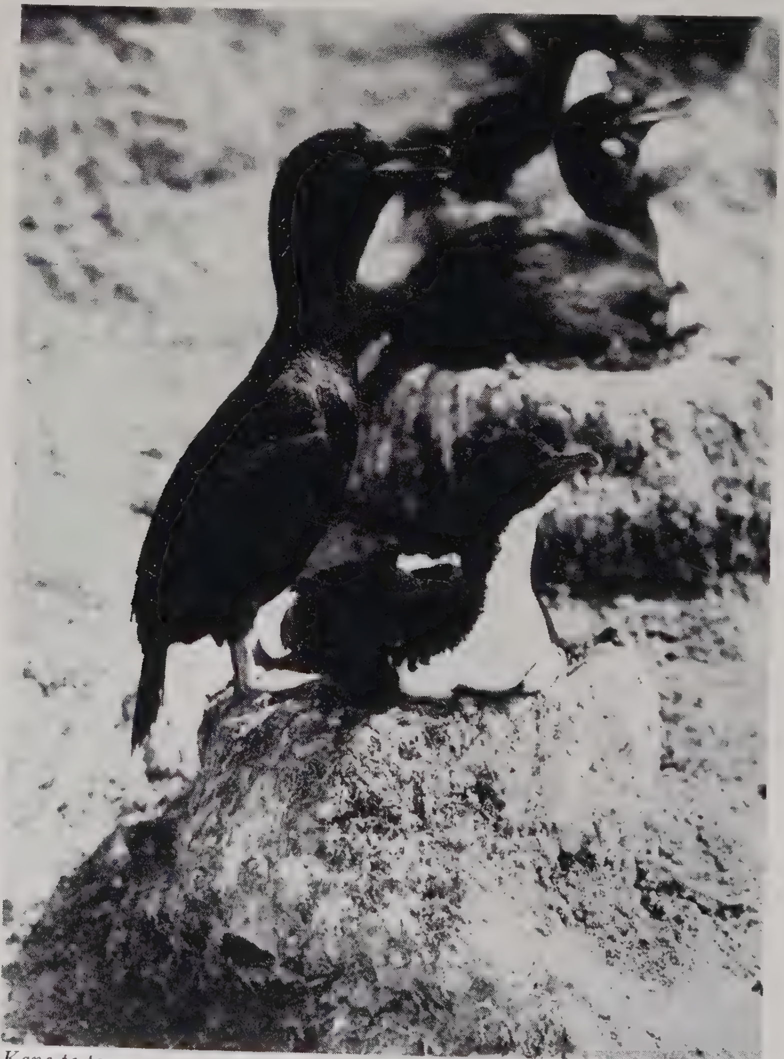
Eggs. Clutch 2 to 3, elliptic, one end slightly blunter, pale blue with outer chalky covering, rough. 59 x 37, 60.4 x 39.5, 61.4 x 38, 63 x 38 mm. Codfish Island.

Status. The Bronze and Stewart Island Shags freely breed together in every known colony. With most of the birds like pairs with like, but a percentage of mated bronze and pied birds are to be seen. Guthrie-Smith saw eleven such pairs when he visited Kane-te-toe. Apparently in nearly all cases the young are either bronze or pied, but a few Bronze Shags with some white feathers on the under surface have been taken. The colours of the bill, face and feet are identical in both forms.

Thus we have two distinct colour phases each of which for the most part behaves as a separate species, but they associate in their breeding ground and to a certain extent overlap, bronze mating with pied. They are like two species which have arisen from the same stock but which have not yet fully separated physiologically. In the future they may well develop into two species unable to cross and produce fertile offspring. They should, in my opinion, be given some taxonomic, and nomenclatural, recognition. Lumping the two forms as a "dimorphic" species tends to obscure the important fact of their distinctness. It is more scientific and convenient to acknowledge this distinctness by considering them two taxonomic units of very close affinity. As with the other melanistic forms in New Zealand which have become established, in part, as groups breeding among themselves I am giving the Bronze Shag species status. There are several instances of similar associations of two colour forms among New Zealand birds. Since such forms are more closely associated than is usual with species it might be convenient to use a term to come between species and subspecies. I suggest semispecies as suitable as it indicates that the species are not properly separated.

Distribution. Coast of Otago from Otago Peninsula to Dusky Sound; Stewart Island, northern coast from Masons Bay to Paterson Inlet. Snares Island, one occurrence. Breeding on Otago Peninsula, Stewart Island, off Codfish Island and formerly on east side of Lake Te Anau.

Habitat. Apparently a purely coastal



Kane-te-toe

H. Guthrie-Smith

BRONZE AND STEWART ISLAND SHAGS

species and sedentary in its habits. It frequents rocky coasts and islets, and the inlets of Stewart Island and the sounds of the west coast of Otago.

Nesting. The Bronze Shag breeds in the same colonies as the Stewart Island Shag. Guthrie-Smith, on the island of Kane-te-toe, off Stewart Island, counted no fewer than eleven mated pairs of the Bronze and Stewart Island Shags and published a photograph of one of them. There can be no question therefore that the two forms habitually interbreed. The breeding season extends over a considerable portion of the year. R. Henry, writing from Dusky Sound, says that eggs and young are to be found at all seasons of the year. Guthrie-Smith states that on Kane-te-toe the breeding season must extend over several months. On October 10th, he found all stages from fresh eggs to fully fledged young. The descriptions of the nests seen by Seymour on Otago Peninsula and Guthrie-Smith at Kane-te-toe are similar. "Each nest is a squat compact pillar," states Guthrie-Smith, "the base probably years old and formed of consolidated sea wrack and guano. The top of each pillar is slightly concave, and there, on a bed of fouled seaweed lie the eggs or young." Concerning the formation of these nests Seymour states that they are "constructed of tussock grass, but the outside soon becomes plastered over with the excrement of the old and young birds. This hardens into a substance resembling stucco which protects the nests against the destructive influence of the weather. By the accumulated layers of successive seasons, the nests are raised in some cases to as much as 18 inches above the surface of the rock. The diameter varies from 18 to 24 inches."

Guthrie-Smith describes the breeding colony of the Bronze and Stewart Island Shags on Kane-te-toe in these words: The space occupied by this community of birds is parcelled into three portions, each of which has its own use and purpose, and each of which is devoted to certain classes of the commonwealth. The main rock is occupied by the older and more experienced breeders. Towards the southern edge of these nesting grounds is the Alsatia of Kane-te-toe, wholly given up to thieving and riots, where might is right, and where only present possession is respected. To the north-west dwell the youngsters of the season, fully fledged and of varying ages, and thereabouts the crags and ledges are densely peopled by these immature citizens.

References.—Gray, Zool. Erebus and Terror, Birds, 20, col. pl., 1845 (*Graculus chalconotus*, Otago). Pucheran, Voy. Pole Sud., 3, 127, col. pl., 1853 (*P. glaucus* Otago). Buller, Birds N.Z., 334, 1873; 2nd ed., 2, pp. 162, 163, 1888 (*P. chalconotus, P. glaucus*); Suppl., 2, 33, 1905. Oliver, N.Z. Jour. Sci. Tech., 6, 326, 1926. Falla, Rec. Auck. Mus., 1, 148, 1932. Mathews, Suppl. Birds Norf., Lord Howe Is., 142, 1936.

Stewart Island Shag

Phalacrocorax huttoni (semispecies)

The Stewart Island Shag was collected on several occasions in Otago prior to 1888 when Buller described a young example, obtained at Dunedin in 1876, as *P. huttoni.* Adult specimens had been referred to *P. carunculatus* until the species was obtained in Stewart Island and Ogilvie-Grant founded his species *stewarti.* Perhaps the most important event in the history of this shag, however, was Guthrie-Smith's discovery of its breeding freely with the Bronze Shag. This was in 1911, but more than twenty-five years before, Seymour had discovered the two forms breeding in the same colony on Otago Peninsula but failed to see white-breasted and dark birds mated.

Adult. A well developed crest in the breeding season. Upper surface and thighs bluish black, wings and interscapular region glossed with oil-green; quills and tail feathers black. Alar bar and dorsal patch white. Under surface white, the white of the throat extending into the interramal region. Bill pale brown, darker on the culmen. Iris brown. Ring round eye pale ultramarine, bare skin on face dark brown; some red or orange papillae at base of cul-

Kane-te-toe *H. Guthrie-Smith*

BRONZE AND STEWART ISLAND SHAGS

men; gular pouch arterial red. Feet pinkish, toes and soles dark brown. Bill 51-63, wing 260-330, tail 109-140, tarsus 55-68, outer toe 101-120 mm. *Immature.* Upper surface brown, the feathers with pale margins; mantle blackish brown, the feathers with dark edges; lower back, rump and thighs glossy greenish black; quills blackish brown with a greenish gloss. Under surface white. No white alar bar or patch on back. *Nestling.* When hatched naked, black; later covered with sooty brown down, some mottled white on the under surface. Upper mandible dark brown, lower white. Bare skin on face black. Feet blackish brown, claws whitish. For *hybrids* see under Bronze Shag.

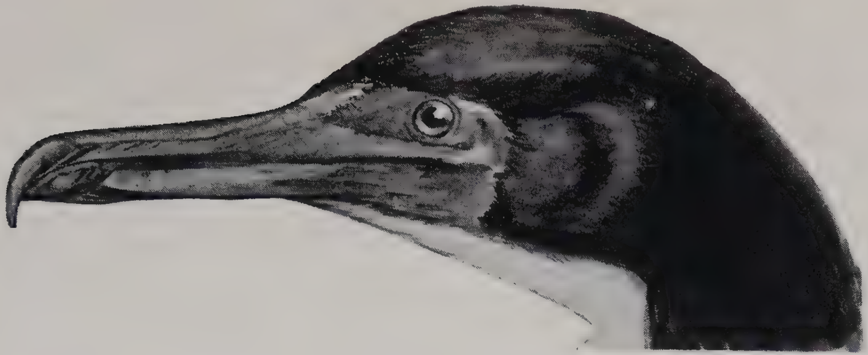
Eggs. Clutch two or three, ovoid-elliptical, pale greenish with thin irregular chalky layer, 63.5 x 41, 67.8 x 40 mm. Islet near Codfish Island.

Status. See also under *P. chalconotus. P. huttoni* is near *P. c. ranfurlyi* but is distinguished by the presence of a white dorsal patch and by the absence of dark colour on the foreneck in the immature stage. From *P. carunculatus* it is separated by its smaller size, presence of a crest, lack of definite carunculation on the forehead, absence of white patches on the scapulars and more purplish thighs.

Distribution. Southern coast of Otago from Chalky Sound to Shag River. Stewart Island, northern half. Breeding on Otago Peninsula, islets off Stewart Island and Dusky Sound.

Nesting. The nesting habits of the Stewart Island Shag are described under the Bronze Shag. Some additional records are: eggs on Kane-te-toe August 20; fully fledged young at Cape Saunders in November.

References.—Buller, Birds N.Z., 2nd ed., 2, 174, 1888 (*P. huttoni,* Dunedin); Suppl. 2, 30, 1905. Ogilvie-Grant, Cat. Birds Br. Mus., 26, 385, col. pl., 1898 (*P. stewarti,* Bluff). Guthrie-Smith, Mutton Birds, 175, 1914. Falla, Rec. Auck. Mus., 1, 47, 1932. Mathews, Suppl. Birds Norf. Lord Howe Is., 141, 1936.



Nora Stidolph

ROUGH-FACED SHAG

Rough-faced Shag. King Shag

Phalacrocorax carunculatus

An example of this magnificent species was collected by Forster in Queen Charlotte Sound during Cook's second voyage. Forster's description of *Pelecanus carunculatus* was not published until 1844 but Latham described his "Carunculated Shag" from Forster's specimen and painting, and Gmelin in 1789 Latinised Latham's name. The Russian explorer Bellinghausen visited Queen Charlotte Sound in 1820 and collected "Cormorants with a bluish eye membrane." It was not until 1875 when H. H. Travers collected the species again in Queen Charlotte Sound that its proper status in the New Zealand avifauna was established.

Adult. A few of the feathers on the top of the head elongated. Top and sides of head, and back and sides of neck black glossed with metallic bluish green; interscapular region, scapulars and wings black glossed with oil-green; lower back, rump and upper tail coverts dark metallic bluish green. Quills and tail feathers black. A white alar bar and a dorsal white patch. Patches of white feathers among the scapulars. Under surface white, the white of the throat extending in a narrow band into the interramal space. Bill light horn colour, brown on the culmen, bluish grey at base of lower mandible. Nasal caruncles well developed, orange. Iris hazel-grey. Ring round eye blue, bare skin on sides of face papillate, greyish brown, gular pouch greyish green. Feet flesh white, hinder part of tarsi and under surface of toes blackish brown. Bill 62-72, wing 297-313, tail 120-140, tarsus 65-70, outer toe 110-120 mm. *Immature.* Upper surface brown slightly glossed with green, especially on the lower back and rump; scapulars and wing coverts pale brown with whitish margins. Quills dark brown with greenish tinge. Tail dark brown the feathers bordered with buffy. No white alar bar or dorsal patch. Under surface white. Nasal caruncles not developed. Upper mandible brown, lower mandible white. Bare skin on face flesh colour. Feet flesh white. *Nestling.* Hatched naked, black, soon growing a thick coat of sooty brown down. Bill brownish black, the lower mandible, except at the tip, as well as the skin at its base to a straight line from the angle of the mouth, bluish white. Iris greenish grey. Bare skin on head black. Gular pouch bluish white. Feet brown.

Eggs. Clutch one or two, elliptical, pale blue with a chalky incrustation. 64 x 43.4, 66 x 42, 68.6 x 42.7, 64.3 x 43 mm.

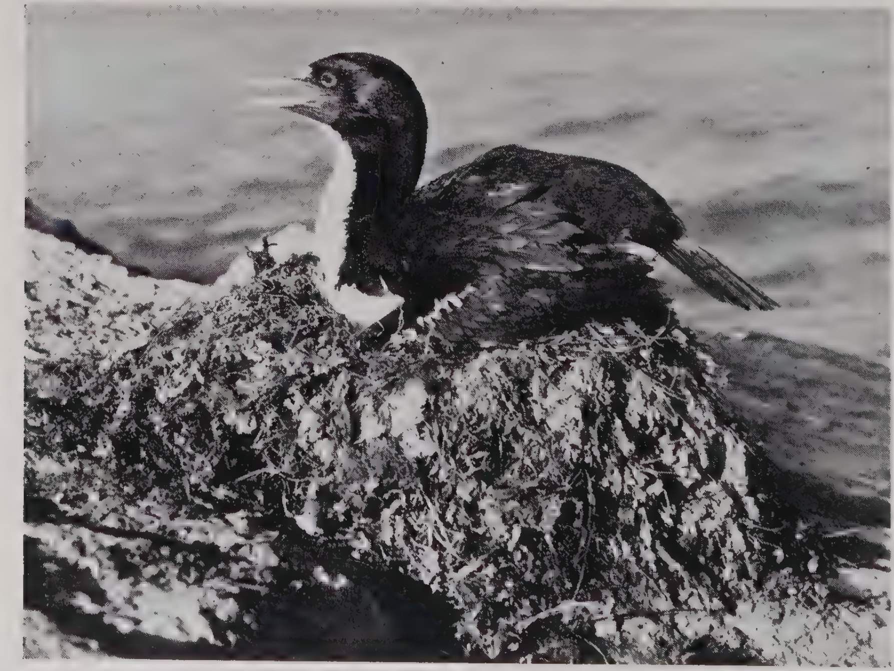
Status. The Rough-faced Shag is the largest of the New Zealand blue-eyed shags. Its distinctive characters are the well developed nasal caruncles, the absence of a crest and the presence of white feathers among the scapulars as well as on the wings and back. All these characters separate it from the Stewart Island Shag. The white scapulars distinguish this shag from all other species in the New Zealand region. From the Chatham Island Shag it is further distinguished by its larger size, absence of crest and metallic green instead of steel blue upper surface.

Distribution. Marlborough Sounds, occasionally as far south as Cape Campbell. Breeding on White Rock, stacks off Forsyth Island, Sentinel Rock (formerly), Trio Islets and Chetwode Islands.

Ecology. The Carunculated Shag is a sedentary species, so far as is known never going far from its breeding place. All the year round it is to be seen on the rocky shores of the islets off the Marlborough Sounds or fishing in the waters nearby. It has never been reported as common. Latham, presumably on Forster's information, stated that it was not in plenty. In 1876 H. H. Travers said there were 40 or 50 nests and in 1938 Falla counted 40 of which 30 were occupied. Recently a decrease in numbers of birds was reported. Seeing that, being a shag, it is thought to be fair game for anyone with cartridges to spare, its small numbers, now probably less than a hundred, place it in a dangerously low category.

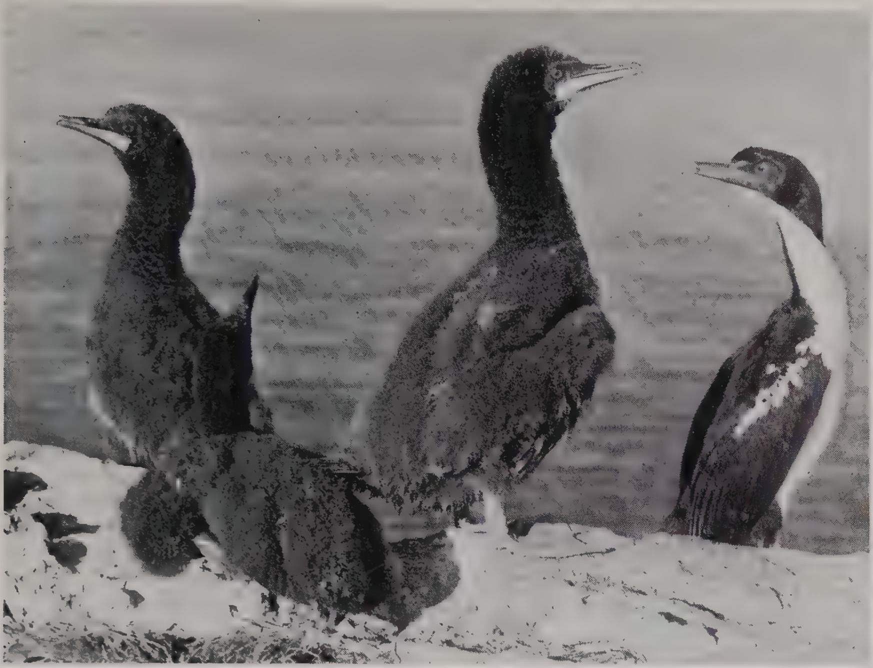
Food. The stomach contents of birds examined by Falla included a small red rock fish, blue cod, crabs and crayfish. Other foods which the Rough-faced Shag is known to eat are red cod, pilchard and whale feed.

Nesting. On White Rock at the entrance to Queen Charlotte Sound Captain Fairchild described this species as nesting in a small colony on bare rocks surrounded by large numbers of the Black Shag which made nests of leaves and seaweed. This was in November 1885 and there were then large birds in the downy stage. This breeding ground was visited by Falla in August 1932 and from his account the following information is taken. The nests are built on exposed sloping rock faces. They are about two feet



White Rock *K. V. Bigwood*

ROUGH-FACED SHAG



White Rock *K. V. Bigwood*

ROUGH-FACED SHAGS
Nestlings and Adult

in diameter and as high as fourteen inches, the lower side being built up so that the top is horizontal. Plants for constructing the nests are mostly gathered from Cooper's Island about two miles away and include grass, taupata twigs, scurvy grass (*Lepidium oleraceum*) and pig face (*Mesembryanthemum*). These are cemented together by a liberal impregnation of the birds' excrement. Old foundations are used year after year, being reinforced with sticks and guano. At the time of Falla's visit there were addled eggs or chicks in the nests, one in each nest, except in a few cases where there were two eggs. The time of laying was considered to be early June.

References.—Gmelin, Syst. Nat. 576, 1789 (*Pelecanus carunculatus,* Queen Charlotte Sound). Buller, Birds N.Z., 2nd ed., 2, 155, 1888; Suppl., 2, 25, 1905. Falla, Rec. Auck. Mus., 1, 145, 1932; Emu, 33, 44, 1933.

Chatham Island Shag

Phalacrocorax onslowi

The Chatham Island Shag was discovered by H. H. Travers during his visit to the Chatham Islands in 1871. In the first edition of his *Birds of New Zealand,* Buller described and figured it under the name of *Phalacrocorax carunculatus* and it was not until 1893 when Forbes published a paper on the birds of the Chatham Islands that it was described as a distinct species and named after the Earl of Onslow, one of the Governors of New Zealand, who did much towards the protection of bird and plant life.

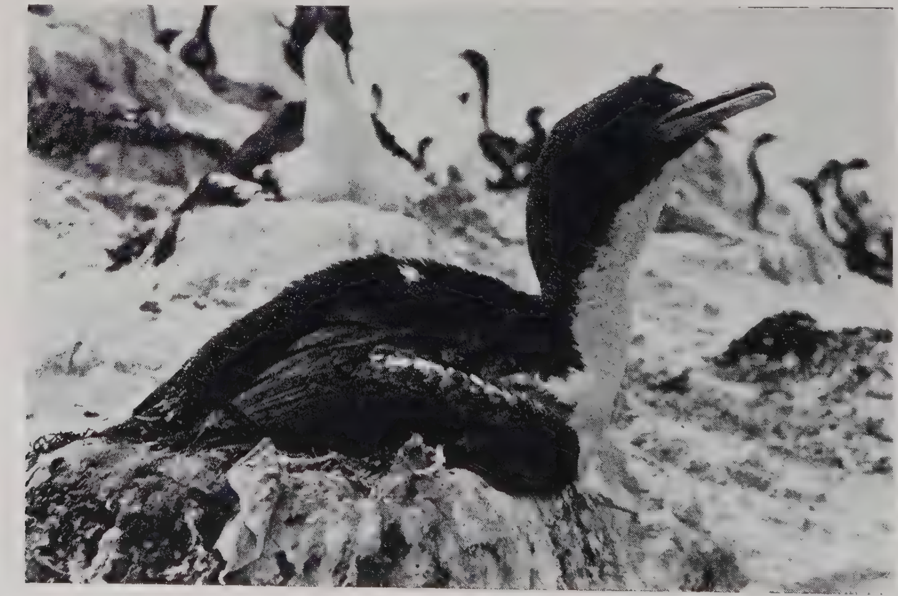
Adult. A well developed crest on the crown of the head and white filoplumes on the neck in the breeding season. Upper surface and thighs dark purplish steel-blue; shoulders, scapulars, and wing coverts shining olive-green; a white alar bar and dorsal patch present; quills brownish black; tail black. Under surface white, the white of the throat extending into the interramal space. Bill blackish horn on upper mandible, bluish horn on lower. Iris brownish grey. Nasal caruncles, a cluster on each side above the upper mandible in the breeding season, orange. Ring round eye bluish slate, bare skin on face and gular pouch orange red. Feet flesh colour. Bill 52-56, wing 274-285, tail 115-133, tarsus 55-60, outer toe 119-118 mm.

According to Fleming the dorsal patches first appear as two areas of white feathers about half an inch in diameter, one on each side of the back. These patches grow until they may be two inches in diameter without uniting. Usually they unite to form a band one to two inches deep extending across the back. There is no evidence as to whether or not the eventual maximum size is correlated with the age of the bird. *Immature.* Upper surface brown, darkest on the back, rump and thighs, which are slightly glossed with green, and palest on the wing coverts and scapulars which are edged with white. Tail dark brown, the feathers edged with buffy. No white dorsal patch; no nasal caruncles. Bill blackish horn on upper mandible, bluish horn on lower. Iris greyish brown. Bare skin on face blackish; gular pouch pale blue. Feet blackish brown. The facial skin and the feet are lighter coloured than in the nestling. *Nestling.* Hatched naked, later covered with smoky brown down with a variable number of white filoplumes.

Eggs. Clutch three, ovoido-elliptic, pale blue with chalky outer layer, 56 x 37, 58 x 39.5, 62.5 x 39, 65.5 x 40 mm. (Fleming.)

Status. The nearest relative of the Chatham Island Shag is the Rough-faced Shag from which it is distinguished by the presence of a crest, its smaller size, its steel blue colouration and the lesser amount of caruneulation on the forehead.

Distribution. Chatham Island where it is common, breeding at a number of points along the coast. Breeding colonies are also reported at the Sisters to the north-west of the main island and on Rabbit Island, the Star Keys and Pitt Island in the south-east.



Chatham Island *C. A. Fleming*

CHATHAM ISLAND SHAG

Ecology. The Chatham Island Shag is a sedentary species not straying far from its breeding areas along the coast. According to Fleming, "in Pitt Strait and around the main island this Cormorant is very abundant and is constantly seen at sea, usually within a few miles of the shore, settled on the water and diving for food or flying with laboured wing beat."

Fleming describes the operations of Red-billed Gulls which form small colonies within the large breeding colonies of the shags. He says that when a stampede occurs among the shags the parasitic Red-billed Gulls are invariably found in close attendance to reap the benefit of such disturbances. "In addition to eating broken eggs, the gulls will consume the disgorged stomach contents of old and young shags, and have even been observed worrying nestlings until they disgorged."

Nesting. Fleming's account includes the following observations. "Breeding colonies may be either on outlying stacks, a few feet above the level of wave wash, or on ledges on outstanding headlands fifty feet or more up a cliff. The nests are regularly-arranged 'chimney-pot' structures of grass, seaweed and feathers, firmly cemented with droppings. Birds alight on the edge of the colony and run the gauntlet of sitting birds as they make their way down the 'alley-ways' between the nests. Every sitting bird seems to resent the presence of a neighbour within range of its swaying head. An unguarded nest is always subject to loss of nesting material, which is surreptitiously snatched by passing birds. . . . At Okawa, on December 6, all stages from fresh eggs to young in flight were present. At Tuparonga, on December 8 and 14, the fifty or so nests contained eggs in all cases except three in which naked chicks had emerged. The season thus varies considerably between one colony and another and even within a colony."

References.—Forbes Ibis., 1893, pp. 533, 537 (*P. onslowi, P. rothschildi*). Buller, Birds N.Z., 332, col. pl., 1873 (*P. carunculatus*); 2nd ed., 2, 153, col. pl., 1888 (*P. imperialis*); Suppl., 2, 37, 1905. Falla, Rec. Auck. Mus., 1, 149, 1932. Fleming, Emu, 38, 409, 1939.

Macquarie Island *A.N.A.R.E.*

MACQUARIE ISLAND SHAG

Macquarie Island Shag

Phalacrocorax albiventer purpurascens

The Macquarie Island Shag was first collected by Bellinghausen, commander of the Russian Antarctic expedition, in 1820. It was next reported by J. H. Scott in 1880 but being referred by Buller to *Phalacrocorax carunculatus* little further notice was taken of it. Scott and later A. Hamilton found it breeding. Some years later, specimens obtained through H. H. Travers reached Lord Rothschild, who recognising its distinctness, described it, naming it after his collector.

Adult. A well developed crest of a few feathers. Top and sides of head, back of neck, back to upper tail coverts and thighs glossy steel blue with purple reflections. Crest, wings and scapulars black with an oil green gloss. Primaries and tail feathers brownish black slightly glossed with green. A narrow white alar bar but no white dorsal patch. Under surface white, the upper border beginning at gape and passing straight backwards so as to leave only a narrow blue portion at the back of the neck. Longest under tail coverts black. Bill greyish brown, darkest on the culmen. Iris greyish hazel. Frontal caruncles prominent, deep chrome, skin round eye blue, other facial skin and gular patch brown spotted with chrome. Feet flesh colour, joints brown. Bill 53-65, wing 278-320, tail 117-150, tarsus 51-65, outer toe 95-107 mm. *Immature.* Upper surface brown with faint green gloss here and there; pale patches in region of alar bar; no caruncles nor yellow dots on face, skin about eyes bluish grey; feet as in adult but more stained with brown. (Falla.) *Nestling.* Naked and black when newly hatched, except for pale pink throat pouch and slaty bill and feet. Later covered with sooty brown down. Throat pouch and sides of mandibles pinkish or white. (Falla.)

Eggs. Clutch three, ovoido-elliptic, pale blue with a chalky outside layer. 66 x 41, 65.5 x 39, 64.4 x 40.2 mm.

Status. The Macquarie Island Shag is readily distinguished from the other New Zealand species of *Leucocarbo* by the white of the under surface coming up as far as the gape and by the interramal space not being feathered. *P. albiventer* differs from *P. atriceps* in the less extensive white alar bar, the absence of a white dorsal patch and the upper border of the white of the under surface not rising above the gape.

Distribution. Macquarie Island and the adjacent Bishop and Clerk Rocks, remaining on these islands all the year round.

Other subspecies are: *P. a. albiventer.* Patagonia and Falkland Islands. *P. a. melanogenis.* Crozets. The three forms are closely allied and have been united by ornithologists under one specific heading. In nature they are separated by oceans of cold stormy waters.

Food. According to Ainsworth this species lives entirely on fish.

Nesting. The nesting cycle of the Macquarie Island Shag is thus briefly described in H. Hamilton's notes (quoted by Falla) made while a member of the Australasian Antarctic Expedition in 1912. The nest is a solid structure of tussock grass, seaweed and mud, about fifteen inches high, sometimes built on top of earlier nests. "17th August, shags starting to make nests. 24th October, shags have completed their nests. 3rd November, fresh eggs collected at Lusitania Bay. 5th November, eggs at West Point rookery showed signs of longer incubation. 13th December, naked chicks about ten days old at Lusitania; period of incubation therefore five weeks or less. 10th March, rookery at Aerial Cove deserted."

References.—Lesson, Traite d'Orn. 8, 604, 1831 (*Carbo albiventer,* Falkland Is.). Brandt, Bull. Sci. Acad. Imp. St. Petersb., 3, 56, 1837 (*Carbo purpurascens,* Macquarie Id.). Buller, Birds N.Z., Ed. 2, 2, 156, 1888; Suppl., 2, 40, 1905. Rothschild Bull. Br. Orn. Club., 2, 81, 1903 (*Phalacrocorax traversi,* Macquarie Island). Falla, B.A.N.Z.A.R.E., Ser. B., 2, 220, 1937.

GENUS STICTOCARBO

Bill long, slender, slightly compressed and of nearly even height throughout; upper mandible hooked at the tip, lower mandible straight. Two crests in the breeding plumage. Tail composed of 12 feathers.

Stictocarbo is distinguished from Phalacrocorax by its long slender bill. Although in Phalacrocorax the bill varies greatly in size it is always stout, whereas in Stictocarbo it is always very slender. Accompanying the narrow bill are two crests in the breeding plumage and 12 feathers in the tail. The two New Zealand species are closely allied in structure, colour and habits and, by the same standards, differ from all other shags. There are no species outside New Zealand unless the South American *P. gaimardi* be included in the genus. It has grey, though not spotted, plumage and its voice is described as a high-pitched chirp, but it does not develop crests and it has 14 tail feathers. Its bill is like *Phalacrocorax* subgenus *Leucocarbo* and the colour of its legs is red. It may be a development of the *Leucocarbo* group parallel with *Stictocarbo* in New Zealand.

Key to New Zealand Species

White band over eye and down side of neck.
Broad behind eyes .... *S. p. punctatus*
Narrow behind eyes .... *S. p. steadi*
No white band on side of neck *S. featherstoni*

Reference.—Bonaparte, Compt. Rend., 41, 115 1855 (*Stictocarbo*, type *Pelecanus punctatus*, Sparrm).

Spotted Shag. Parekareka

Stictocarbo punctatus punctatus

This beautiful shag was one of the species collected by Forster in Queen Charlotte Sound during Cook's second voyage. Forster noted that it was seen diving, and standing erect on rocks near the water. The first published description (1786) was that of Sparrman who joined the expedition at the Cape of Good Hope. The next notice of this species is by Dieffenbach who observed it in Cook Strait about 1840. It is a local species and has since been discovered in various other parts of New Zealand from Hauraki Gulf to Otago Peninsula.

Adult. In the breeding season the feathers of the forehead and occiput are elongated forming two crests. Top of head, crests, back of neck, and mantle black, glossed with greenish blue, the crest feathers brownish grey at the base. On each side of the head a white stripe begins at the base of the bill, passes above the eye and continues down the side of the neck to the shoulder. It widens out considerably on the side of the neck reaching to the occipital crest. Upper back, scapulars and wing coverts light brownish grey, each feather with a black spot at the tip; lower back, rump, upper tail coverts, flanks, lower half of abdomen and under tail coverts dark greenish blue; quills dark greyish brown; tail feathers black; in the breeding season white filoplumes and narrow feathers scattered on the head, neck, lower back, and thighs. Sides of head, throat, and foreneck sooty black; breast and abdomen pale grey. Bill brownish yellow, horn colour at the tip. Iris green. Ring round the eye greenish blue; skin between eye and bill dark blue. Feet yellow. Bill 60-68, wing 230-245, tail 80-93, tarsus 50-58, outer toe 85-95 mm. *Immature.* Crown, hind neck, mantle, scapulars and upper surface of wings grey brown, each of the feathers of the mantle and scapulars having a small black spot at the tip; back, rump, tail and thighs ashy brown glossed with green. Stripe on side of neck mottled ashy brown and white. Under surface greyish white tinged with cream. Bill pale horn. Bare skin on face and feet at first flesh, later becoming yellow. A few small white filoplumes may be present on neck and flanks. *Nestling.* Hatched naked, lead colour; bill, gular pouch and feet flesh colour. First down dark brown above, whitish below. Second down slaty brown above, almost white below; lores and gular pouch purplish flesh. *Colour variety.* A pure white bird is described by Buller from Kaikoura.

Eggs. Clutch two to four, elliptic, blunt at both ends, or one end more obtuse than the other, pale blue with a chalky outside layer, 54 x 35, 57 x 35 mm. Waiheke Island. 61.2 x 35.5, 62 x 38 mm. Banks Peninsula.

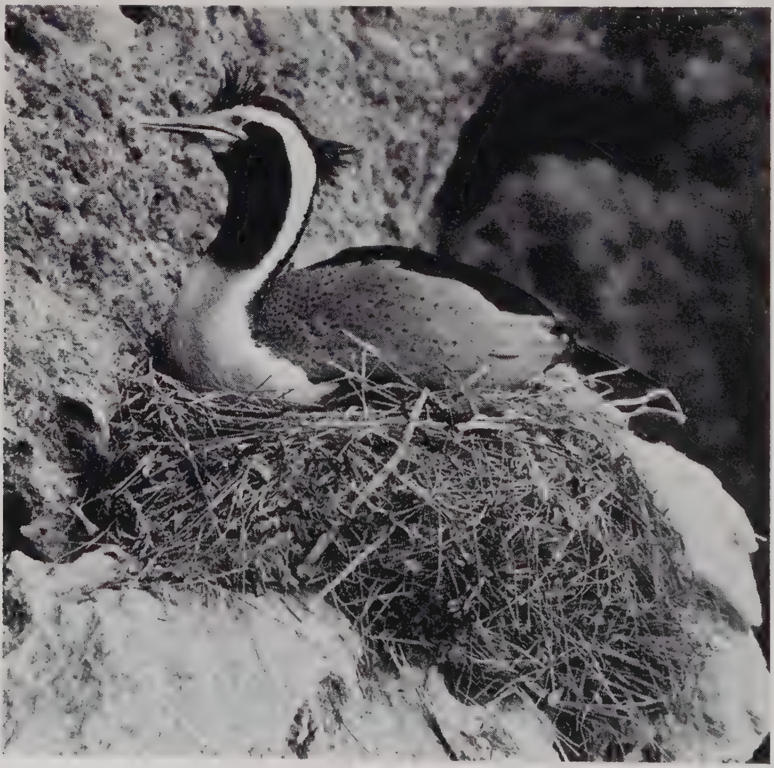
Status. Very closely allied to the Blue

Shag, *S. p. steadi,* and accordingly given subspecific rank with it to form the species. *S. p. punctatus* is distinguished by its lighter upper surface and broader white stripe on the side of the head.

Distribution. Discontinuously distributed from North Auckland to North Otago. Formerly much more abundant and breeding at Bay of Islands and Cape Kidnappers. Present breeding localities are: Waiheke, Tarakihi, Noises, Te Henga and Girdwoods Point, Oaia (?), Chetwode Islands, Port Underwood, Motungaratiti, Banks Peninsula, Perpendicular Point, Point Elizabeth, Ten Mile, Steeples, Taumaki Island (Westland), Otago Peninsula, North Otago Head, and Purakanui. It has been observed at Whangarei, Rurima Rocks, Kapiti, Waikanae, Palliser Spit, Amuri Bluff, Rakaia River mouth, Timaru, Oamaru, Shag River mouth, and other places. Stragglers have been taken at the Snares (immature bird) and at Macquarie Island.

Ecology. The spotted Shag is a sedentary species usually not going far from the place where it was reared. At all times of the year old and young are to be seen sitting on the rocks along the shore or fishing nearby. Forster's note quoted above describes this characteristic. The Spotted Shag does, however, travel long distances from its nesting cliffs to its feeding grounds, up to 50 miles or more. Large numbers, for instance, may be seen at Timaru and Oamaru. It is a cliff and cave dweller, favouring especially vertical cliffs with the sea at their base. It is never seen to settle on trees.

Like other coastal breeding shags the Spotted Shag has suffered severely through the advance of settlement carrying with it the idea that all shags are harmful. It has been cleared from long sections of the coast



Banks Peninsula *K. V. Bigwood*

SPOTTED SHAG

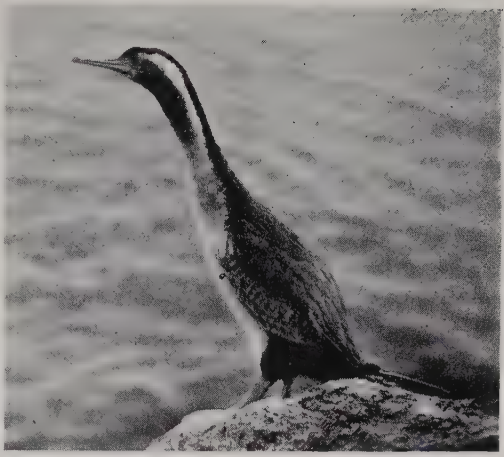
especially where it built its nests on sloping rocks. In several localities, however, notably Banks and Otago Peninsulas, it resorts for breeding to sea cliffs where it is comparatively safe.

The relationship between the Spotted Shag and the Red-billed Gull is thus described by Stead: "It is quite usual to find Red-billed Gulls hanging around a Spotted Shag colony—in fact, they often establish their own nesting colony nearby. When the young shags have been fed, and their parents have left for the sea to get more food, one of the Gulls, which have been watching the whole performance, immediately flies to the nest and, standing on the edge of it, swears at the young Shags (the Gull's whole manner and tone of voice convey just this impression), who forthwith disgorge some of their food, which the Gull promptly eats. The Gulls continue to do this up to the time when the young Shags are getting their feathers, by which time the Shag is a good deal larger than its persecutor. When watching a colony of these Shags, and another of Red-billed Gulls above it, on a cliff at Banks Peninsula, I came to the conclusion that the Gulls got quite a large proportion of their food by this barefaced robbery."

Food. The food of the Spotted Shag consists of crustacea and fish. Sometimes it may be seen fishing singly, but more often a number are seen together, fishing by long dives or following a shoal. Stead states that "when there is a migration of whalefeed, or britt, along the coast, the birds subsist almost entirely on it. They usually travel to and from their feeding grounds in flocks."

Voice. The voice of the Spotted Shag is quite different from that of all other New Zealand shags. It might be described as a high pitched whistle.

Nesting. The breeding colonies of the Spotted Shag are situated on sea cliffs and coastal rocks, sometimes in quite inaccessible places, at other times merely on sloping rocks. Great numbers formerly bred together but except in a few localities small colonies only now exist. On Waiheke, in the Hauraki Gulf, the nests are well built of sticks lined with grass and placed on convenient ledges and crevices on the cliffs. On the south coast of Banks Peninsula the nests are in rows on the ledge of vertical sea cliffs far above the water's edge. Seaweed is often used in lining the nests, the foundation of which is made of sticks. According to Stead the nests on Banks Peninsula are built mainly of seaweed, lined with grass or ice plant, and sometimes with a foundation of sticks. The breeding season extends over most of the year but there are indications that laying occurs mostly during certain months, for example, April to July at Kaawa Creek, Noises; July and August at Waiheke; September and October at Te Henga, Cape Kidnappers, Banks Peninsula; and November and December Waiheke, Noises, Cape Kidnappers.



Banks Peninsula *K. V. Bigwood*
SPOTTED SHAG, IMMATURE

The rather remarkable nuptial plumage which develops before egg laying and disappears soon afterwards has been vividly described by Stead. "They grow two forward-curving crests of long soft dark feathers, one on the front of the head, the other at the nape. The front of the neck becomes black, and this is separated from the dark back of the neck by a broad white stripe which runs from the bill, above the eye, right down to the shoulders, the whole of the upper part of the neck being thinly studded with long white filoplumes. The bare skin on the face becomes brilliantly coloured: a ring of greenish blue encircles the eye, and merges into the rich royal blue of the face and throat. . . . Both cocks and hens acquire this gay dress, and in equal degree. All this finery outlasts mating but a week or so. Even before the nest is begun the dainty white filoplumes have commenced to fall out, and by the time that the eggs are laid, few, if any, of these transient ornaments remain. The two crests quickly follow them and ere the first chick chips the shell the fine sooty black of the under neck is beginning to fade, the white stripe is dotted with black, and the birds are going back to their workaday dress."

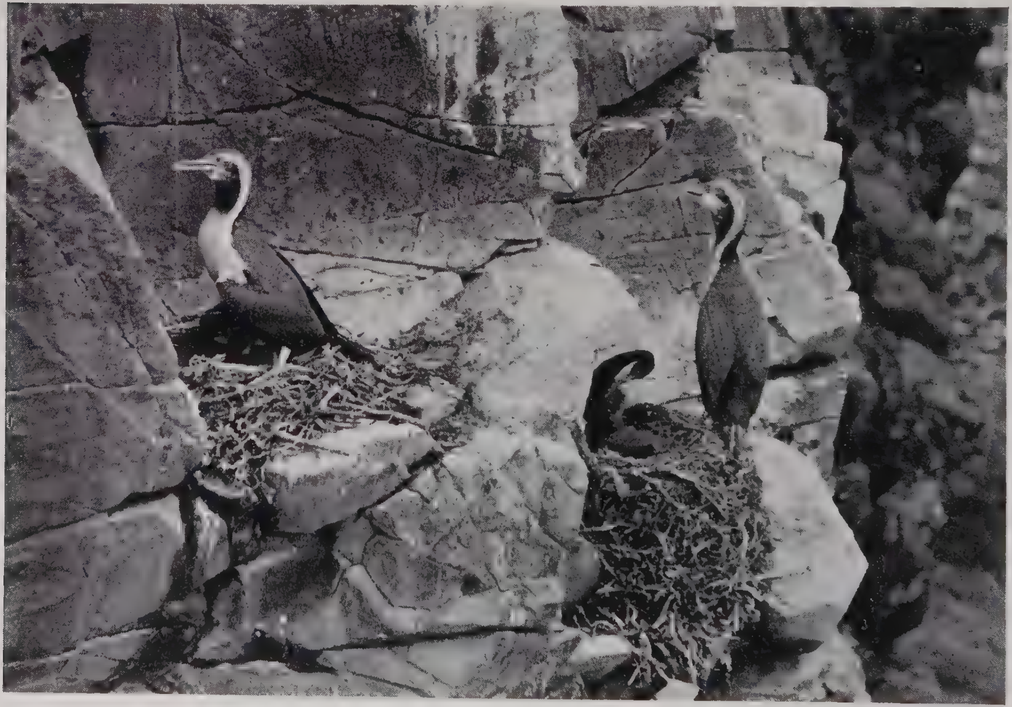
References.—Sparrman, Mus. Carls., fasc. 1, No. X, 1786 (*Pelecanus punctatus,* Queen Charlotte Sound). Buller, Birds N.Z., 335, col. pl., 1873: 2nd ed., 2, 165, col. pl., 1888. Potts, Trans. N.Z. Inst, 5, 201, 1873. M'Lean Ibis, 1889, 299. Stead. Life Hist. N.Z. Birds, 18, 1932. Falla, Rec. Auck, Mus., 1, 151, 1932. Buddle, Bird Secrets, 63, 1951.

Blue Shag

Stictocarbo punctatus steadi

A specimen was obtained somewhere in Otago many years ago and is now the type of the species and preserved in the Dominion Museum. The credit of recognising the species as undescribed belongs to Mr. E. F. Stead who in November, 1929, procured two specimens on the islands off the west coast of Stewart Island.

Adult Male in Breeding Plumage. The feather of the forehead and occiput elon-



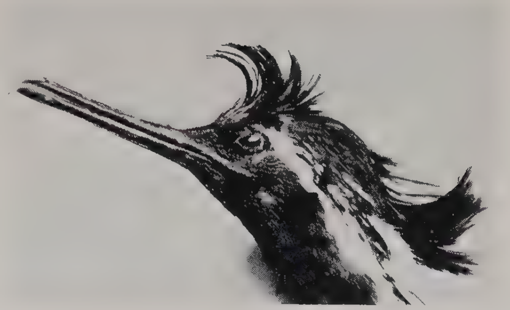
Hauraki Gulf *G. A. Buddle*

SPOTTED SHAG

gated forming two crests. Long white filoplumes on back and neck, shorter ones on foreneck, mantle and flanks. Top of head, crest, back of neck and mantle black glossed with greenish blue, the crest feathers brownish grey at the base. On each side of the head a narrow white stripe begins over the eye and passes backwards but distant from the occipital crest and continues down the sides of the neck to the shoulder. Upper back, scapulars and wing coverts dark greyish brown, each feather with a black spot at the tip. Lower back, rump, upper tail coverts, flanks, lower abdomen and under tail coverts dark greenish blue; quills dark brown; tail black. Sides of head, throat and foreneck sooty black glossed with green; breast and abdomen grey. Bill horn coloured. Iris dark olive. Eyelid greyish olive; facial skin olive green; gular pouch pale green. Feet yellow, brown on joints of toes and front edge of webs. Bill 55-63, wing 240-260, tail 90-115, tarsus 54-57, outer toe 82-86 mm. *Adult Male in Non-Breeding Plumage.* The crests are absent, also the large filoplumes, though small ones are present on the neck and flanks. The white stripes on the sides of the head are mottled with black. Remainder of plumage as in summer. "Bare skin on cheeks and throat sea-green. Pimples near eye verdigris green (vivid). Feet lemon-yellow, with dark brown knuckles." (Stead.) (Specimen from south-west of Stewart Island, 20th Nov., 1929, in Canterbury Museum.)

Status. Differs from *S. p. punctatus* in the white stripe on the side of the head and neck being narrow throughout and not advancing in front of the eye, excepting sometimes as a very fine line, and the upper surface being dark greyish brown instead of light brownish grey.

Distribution. Stewart Island: breeding in small colonies at Codfish Island, Port Pegasus and possibly Centre Island. Present in several other localities in Stewart Island. The Blue Shag is nowhere common. Reported from Fiordland and probably Sandhill Point, Foveaux Strait.


C. J. Lindsay

BLUE SHAG

Nesting. The nests of the Blue Shag are placed high up on ledges of cliffs, often overhanging. Eggs have been seen from November until the end of January, three in a nest being the highest number recorded. Richdale has observed chicks during the last week in January.

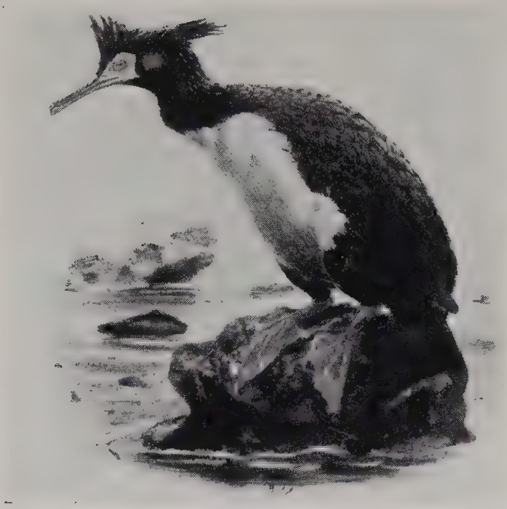
References.—Oliver, Trans. N.Z. Inst., 61, 138, 1930 (*Stictocarbo steadi,* Otago). Mathews, Bull. B.O.C., 51, 18, 1930 (*P. oliveri*); Suppl. Birds Norf., Lord Howe Id., 145, 1936. Falla, Rec. Auck. Mus., 1, 153, 1932. Stead, N.Z. Bird Notes, 3, 79, 1948.

Pitt Island Shag

Stictocarbo featherstoni

Equally as beautiful as the spotted shags, this representative of them in the Chatham Group was discovered by H. H. Travers during his visit in 1871. Travers' specimens were placed in Hutton's hands for description and were referred to an African species, but Buller at once recognised its distinctness and dedicated it to Dr. Featherston, Superintendent of the Province of Wellington. Apparently never a common species, it was reported as nearly extinct in 1905, but Archey and Lindsay in 1923 saw it frequently on Mangere Island.

Adult. Head including the two crests and upper part of neck indigo-black; white filoplumes on neck during the breeding season; shoulders, mantle and upper surface of wings olive-brown glossed with green, each feather with a terminal black spot; back, rump, upper tail coverts and marginal wing coverts indigo-black; quills blackish brown; tail black. Lower part of foreneck, breast



From Buller, Birds of New Zealand
PITT ISLAND SHAG

and middle part of abdomen grey; sides of body, flanks, under surface of wings, lower abdomen and under tail coverts indigo-black. Bill blackish on culmen, remainder horn colour. Iris black. Bare skin on face and gular pouch olive green. Feet orange, brown on outside of tarsus and part of webs. Bill 47-55, wing 227-242, tail 90-100, tarsus 44-51, outer toe 77-88 mm. The female is slightly smaller than the male. *Immature.* No crests. Head, back, rump and thighs brown with greenish tinge. Small white filoplumes on neck. Tail black. Wings and under surface brown. Bill black on culmen, rest horn colour. Iris greyish brown. Bare skin on face brown, gular pouch greyish yellow. Feet dull yellow, brown on outside of tarsus and outer toes.

Eggs. Ovoido-elliptic, pale blue with chalky outside layer, 54.5 x 35, 59.5 x 33, 60 x 38 mm.

Status. On account of the absence of a white stripe I treat this species as of equal taxonomic value to the Spotted Shag which consists of two subspecies.

Distribution. Chatham Island. Occurs sparingly all round the coast, fairly abundant on the south coast. Said to breed at Kaingaroa. Numbers greatest south of Pitt Strait. Breeds on Pitt Island and the adjacent islets of Mangere, Little Mangere, South-east Island, Pyramid Rock, Star Keys and Rabbit Island. This is the position as reported by Fleming in 1937. E. W. Dawson saw many young on the Sisters at the end of January.

Nesting. The only information available is a brief account by Fleming: Nesting sites are in eroded pockets or ledges in vertical cliff faces, the number of nests depending on suitable places available. The nests are of dried vegetation, small and well built. Eggs are said to be laid in August. In December mature birds that had lost their nuptial dress and immature birds were seen diving amongst the kelp in coastal waters or resting on whitened perching rocks nearby.

References.—Buller, Ibis, 1873, p. 90 (*P. featherstoni*, Chatham Is.); Birds N.Z., 338, col. pl., 1873; 2nd ed., 2, 166, col. pl., 1888. Fleming, Emu, 38, 410, 1939.

FAMILY ANHINGIDAE. DARTERS

Bill slender, straight, sharp pointed. Gular pouch small, neck long. Tail long, rounded. Outer toe slightly longer than the middle one.

The Darters are distinguished by the slender sharp pointed bill, long S-shaped neck and rounded tail. They are closely allied to the shags, the chief external differences being the straight bill and the outer and middle toes being nearly equal in length. All are referred to a single genus.

Genus Anhinga

Bill compressed, cutting edges serrated along the terminal half; no lateral grooves; nostrils rudimentary. Neck long and slender. Wing pointed. Rectrices 12. The two central tail feathers and the inner secondaries transversely ribbed.

In the Darters the cervical vertebrae are so articulated as to produce a curve in the neck and the muscular mechanism is such that the birds can suddenly straighten it. By this means the bird transfixes with its bill the fishes it captures.

Four species are distributed over the warmer continental regions of the world. An

Australian species is accidental in New Zealand.

References.—Brisson Orn., 6, 476, 1760 (*Anhinga*, type *Plotus anhinga*, L.). Linne, Syst. Nat., 12th ed., 218, 1766 (*Plotus*, type *P. anhinga*, L.).

Darter

Anhinga novaehollandiae

Only one specimen of the Australian Darter has been taken in New Zealand. The taxidermist of the Canterbury Museum, Mr. F. R. Fuller, when on a visit to Hokitika in January, 1874, found the skin stretched flat and nailed up inside an old shed. He brought it away but could get no information as to how it came there. The skin was evidently in a fresh state when it was attached to the wall and the species has accordingly been accepted as a straggler to New Zealand.

Adult Male. General plumage glossy blue-black; a broad white band on each side of the head; naked part of throat edged with white; a patch of chestnut on the foreneck; scapulars and wing coverts centred with white; quills and tail feathers black. Bill olive-green, base of upper mandible brown, base of lower mandible and skin at base yellow. Iris pale yellow. Feet whitish brown, toes darker. Bill 79, wing 350, tail 220, tarsus 48, outer toe 96 mm. *Adult Female.* Head and hind neck blackish brown, mottled with white; back and rump black; quills and tail feathers black; inner secondaries white on their outer webs; primary coverts black; secondary coverts white on their outer webs; scapulars black with a white stripe on their outer webs. Under surface white; of wings black. Bill 79, wing 355, tail 255, tarsus 50, outer toe 96 mm. Hokitika. *Immature Male.* Similar to the adult female but darker on the back and head; throat and foreneck buff; white streak on side of head and on throat indicated.

Eggs. Clutch three or four, greenish white, covered with a white limy coating, 56 x 38, 59 x 36.5 mm. N. Australia.

Distribution. Hokitika (one occurrence). Australia.

Habits. The Darters feed entirely under water. Propulsion is effected by the feet, but the wings are held half expanded, and the neck curved like an S. When within striking distance of a fish the neck is suddenly straightened and the prey transfixed. The Darter then immediately comes to the surface, jerks the fish off and catches it in its bill and swallows it. The neck is also bent when the bird is flying.

Darters build large nests of sticks in trees growing in water.

References.—Gould, Proc. Zool. Soc., 1847, p. 34 (*Plotus novaehollandiae*, New South Wales). Buller, Trans. N.Z. Inst., 7, 217, 1875; Birds N.Z., 2nd ed., 2, 175, 1888.

FAMILY PELECANIDAE. PELICANS

Bill very long, upper mandible broad, hooked at the tip, lower mandible with narrow vertical rami. Gular pouch enormous. Tail short, wedge-shaped. Toes scutellate, middle toe longest, inner small.

Pelicans are distinguished especially by the long bill with huge distensible gular pouch.

A single genus is here accepted. The species occurring in New Zealand differs from the others in the eye being completely surrounded by a feathered tract. For this reason it has been separated as a distinct genus, Catoptropelecanus.

Genus Pelecanus

The bill in pelicans is composed of a median bar terminating in a hooked nail, and of lateral portions divided from the median by grooves in which lie the small nostrils.

Eight species ranging over the whole world except Polynesia; accidental in New Zealand.

References.—Linne, Syst. Nat., 10th ed., 132, 1758 (*Pelecanus*, type *P. onocrotalus*, L.). Reichenbach, Nat. Syst., Vog. 7, 1852 (*Catoptropelicanus*, type *P. conspicillatus*, Temm.).

Australian Pelican

Pelecanus conspicillatus

In 1890 an Australian Pelican was shot by a Maori on the Wanganui River bank about a mile above Hiruharama. The bird was first observed in the early morning, and being strange, the head was brought to Wanganui for identification, the body being left to the pigs. This is the only known instance of a Pelican finding its way to New Zealand.

Adult. General plumage white; nuchal crest greyish brown; quills and their coverts, scapulars, outer row of lesser wing coverts, sides of rump, shorter upper tail coverts, and tail feathers, black. Feathers of foreneck elongated. Naked skin round eye separated from the bill by a feathered tract. Bill flesh colour, sides slate blue, tip greenish brown. Iris dark brown. Eyelids indigo-blue. Gular pouch flesh colour. Feet light slate colour. Bill 460, wing 650, tail 180, tarsus 125 mm. In the New Zealand specimen the bill measured 445 mm. *Immature.* Differs from the adult in the dark portions of the upper surface being brown instead of black. *Nestling.* Hatched naked, fleshy-pink; later the upper surface becomes covered with white down.

Eggs. Clutch two or three, white, chalky, 90 x 57 mm.

Status. The Australian Pelican differs from all the other species in having the bare skin round the eye completely surrounded by feathers.

Distribution. Wanganui River (one occurrence). Waikaremoana, subfossil.

Australia, New Guinea, Tenimber Islands.

Habits. The Australian Pelican breeds in large colonies by inland lagoons and on islands off the coast. The nests are scraped out depressions in and around which, after the eggs are laid, roots, feathers and anything else within reach or easily obtained are gathered. The young feed by putting their head and neck down the parents' throat by the gape, fish being regurgitated from the crop of the parent for their benefit.

References.—Temminck and Langier, Pl. Color Ois., 3, pl. 276, 1824 (*P. conspicillatus*, New South Wales). Buller, Trans. N.Z. Inst., 25, 61, 1893; Suppl., Birds N.Z., 2, 53, 1905. Macgillivray, Emu, 22, 162, 1923.

FAMILY SULIDAE. GANNETS

Bill strong, conical, the upper mandible slightly decurved at the tip, no visible nasal openings. Gular pouch small. Tail long, wedge-shaped. Outer and middle toes nearly equal.

The powerful conical bill and equal outer and middle toes distinguish the Gannets.

Key to Genera

Interramal space bare, toes reticulate	*Sula*
Feathers extending into interramal space, toes scutellate	*Morus*

There are so many points of difference between the tropical boobies and the temperate gannets that their generic separation is well justified.

GENUS MORUS

Bill stout, conical, cutting edge of upper mandible very slightly serrate; culminicorn shorter than anterior portion of latericorn. Feathering on the throat cleft and extending forward in a double point between the rami of the mandible. Tail of 12 feathers. Toes scutellate, the rows of scutellae on the three front toes extending more than halfway up the tarsus.

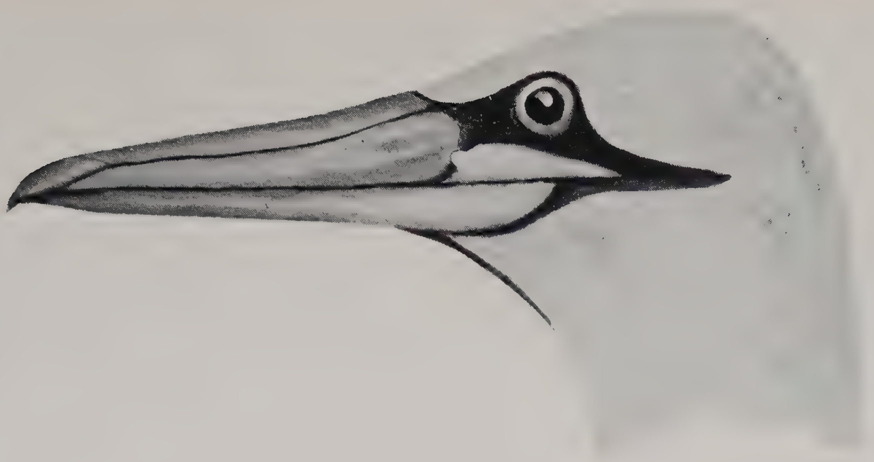
Morus differs from Sula mainly in the feathering of the chin and scutellation of the toes. It comprises three allied species found in the North Atlantic, South Africa, and Australia and New Zealand respectively.

Reference.—Vieillot, Anal. nouv. Orn., 63, 1815 (*Morus*, type *Pelecanus bassanus* Linne).

Gannet. Takapu

Morus serrator

The Gannet presented itself for discovery by Europeans at a most fitting time, at any rate for the crew of Captain Cook's ship *Endeavour*, during his first voyage. The incident is thus described in Sir J. Banks' *Journal*: "24th Dec., 1769. Land in sight; an island or rather several small ones, most probably the Three Kings. From a



C. McCann

GANNET

boat they killed several Gannets or Solan Geese, so like European ones that they are hardly distinguishable from them. As it was the humour of the ship to keep Christmas in the old-fashioned way, it was resolved to make goose-pie for tomorrow's dinner.

"25th, Christmas Day: Our goose pie was eaten with great approbation; and in the evening all hands were as drunk as our forefathers used to be upon like occasions."

The crew presumably having become sober, the voyage was continued and on January 10th, 1770, the ship passed between the mainland and a small island which seemed to be totally covered with birds. This was no doubt Gannet Rock, off Kawhia, one of the breeding places of this species.

Little more is heard of the Gannet until Gray, in Dieffenbach's *Travels*, records it from Queen Charlotte Sound, and two years later, founded the specific name *serrator* for it.

Adult. General colour white; the crown of the head and back of the neck golden buff; primaries, secondaries and four central tail feathers brownish black, with white shafts darkening towards the tip. Bill bluish grey. Iris silvery brown. Bare skin round eye bluish grey; skin at base of bill, gular pouch and between culminicorn and latericorn black. Feet dark brown, scutellations on tarsus and toes (except hind toe) greenish yellow. Bill 90, wing 455-480, tail 220-240, tarsus 50-53, mid toe 95-100 mm. *Immature*. Head and neck white, spotted with black, rest of upper surface dark slaty grey, each feather with a white spot near the tip. Under surface white, mottled with sooty grey on the foreneck and breast. Iris pale yellowish. Bill and feet black. Bare skin round eye dull grey. The brown of the upper surface soon (July) begins to wear and new white feathers begin to replace the brown ones on the head. By the end of October the head and under surface is white like the adult, but the shoulders, back and upper surface of the wings are blackish brown variegated with white, all the new feathers being white. The foregoing is Bullers' account of a captive New Zealand bird in England. It is the only published record of the first moult, but it indicates that further moulting is required before the mature plumage is acquired, and that probably the gannet does not commence to breed until it is nearly two years old. The British gannet takes two and a half years to attain the adult plumage, in this too the changes were described from a captive bird. *Nestling*. Hatched naked, black. Soon covered with long pure white down; bill, bare skin on face and feet black; iris dark brown.

Eggs. Clutch one, elongate, elliptical, narrowed at both ends, bluish white covered with thick chalky layer, 81 x 47, 78.5 x 46.5, 74 x 43.5 mm. White Island.

Status. Closely allied to *M. bassana* of the North Atlantic and *M. capensis* of South Africa. The yellow colour of the head is darker in *M. serrator* than in the other species. *M. bassana* has a white tail, *M. serrator* has the four central tail feathers black, the remainder white, while *M. capensis* has all the tail feathers black. In immature birds the white spots on the wings are larger in *serrator* than in *bassana.*

Distribution. Common in the north of New Zealand during the extended breeding season, scarce elsewhere at all times and in the north as well after the birds have left the nesting stations. Breeds on Three Kings Islands (Princes Islets, Southwest King), Cape Karikari, Poor Knights (Gannet Stack, Sugarloaf), Mahuki (off Great Barrier Island), Horuhoru Rock (off Waiheke Island), Coromandel Peninsula (Bush, Double, Motutakapu Islets), Oaia (off Muriwai), Gannet Island (off Kawhia), White Island, Cape Kidnappers and Black Reef, Nugget Islets (Otago), Little Solander Island (Foveaux Strait). It has been observed on most parts of the coast—Mokohinau Islands, Little Barrier Island, Wanganui River mouth, Waikanae, Kapiti Island, Astrolabe Harbour, Cape Foulwind, Marlborough Sounds and Cook Strait, Banks Peninsula, Waikouaiti, Otago Harbour, Taieri River mouth, Caswell Sound, Chalky Sound, Preservation Inlet, Stewart Island, and, as a casual visitor, the Chatham Islands. Sometimes small breeding colonies become established and afterwards abandoned as, for instance, Karaka Point (near Houhora), Bird Rock (Bay of Islands) and Sugar Loaf in the Alderman group.

Australia, south of Rottnest Island on the west and Moreton Bay on the east. Tasmania. Breeds on Lawrence Rocks, Victoria, and on islands in Bass Strait and off the south coast of Tasmania. Straggler to Lord Howe Island. Gannets ringed in New Zealand have been taken on the coasts of New South Wales, Victoria and South Australia.

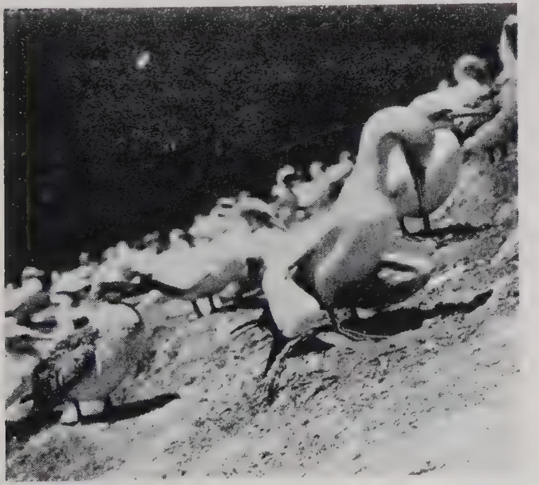
Habitat. All the main breeding places of the gannet are north of 40° S. lat. South of this parallel there are two very small breeding colonies, one at the Nuggets and

White Island *W. R. B. Oliver*

GANNETS

the other at the Solanders, both near S. lat. 46° 30′, where the temperature of the sea water is definitely lower than it is in the north of New Zealand. The South African Gannet breeds in latitudes about the same as does the New Zealand Gannet, but the breeding range of the North Atlantic Gannet extends from 45° to 67° N. lat.

For about seven months of the year the gannet is found at or near its breeding places. During the remainder of the year a few are seen in various parts of the coast often at considerable distances from any breeding localities. Birds seen in Cook Strait, for example, judging by the evidence of ringed birds, come from Cape Kidnappers, 200 miles distant, but though some birds remain on the coast all the year round the great majority seem at least to stay out of sight of land during the months April to August. Perhaps this is why we have no complete account of the changes in plumage from juvenile to adult. Only a rare straggler has been seen at the Chatham Islands, 500 miles east of the South Island. The movements of large numbers of gannets northwards past Mayor Island in the Bay of Plenty during May and June has been recorded by Sladden. From January to March immature birds have been seen off Whangaroa by T. M. Roberts moving north. But J. M. Cunningham has reported, on the evidence of Mr. Max Nicol, the southward movement of separate flocks of adult and immature birds off Flat Point during the third week in March.



Cape Kidnappers *W. R. B. Oliver*
GANNET DANCING

The Ornithological Society of New Zealand, during the last few years has been making a census of the breeding colonies of the Gannet. In the report published by Fleming and Wodzicki the approximate figures are as follows: Three Kings, 4100; Horuhoru, 1200; Poor Knights, 1500; Coromandel 1800; White Island, 5200; Gannet Island, off Kawhia, 3700; Cape Kidnappers, 2700; other breeding places, 800; total 21,000 breeding pairs. This compares with 166,000 birds for the North Atlantic Gannet.

The Gannet in New Zealand is certainly increasing in numbers. The Cape Kidnappers colony, the only one on the mainland, in 1880 contained only about 50 birds, according to H. Hill who visited it about that time. In 1922 H. S. Cottrell estimated the breeding birds at 4000 while in 1952 Fleming and Wodzicki made the number about 5500. The area occupied by the colony has expanded in the last few years by birds moving to Black Head and the high ground at the cape.

Food. The food of the Gannet consists mainly of small surface living fishes such as garfish, herrings and young mullet, but squids are also caught. As is well known the Gannet's method of fishing is to dive vertically from aloft. It flies parallel with the surface of the water and at a height of from 20 to 30 feet or more, but in shallow water near the shore it works from a height of only a few feet and dives in a slanting direction. On sighting a fish the bird suddenly drops vertically with head outstretched and wings partly folded until it almost reaches the water when the wings are brought into the body. The bird disappears for a few seconds to rise with a fish in its mouth. This is quickly swallowed and the Gannet again rises into the air to search for more examples of its finny prey.

Cape Kidnappers *W. R. B. Oliver*

GANNET FEEDING YOUNG

There is no more interesting sight than a flock of Gannets feeding on a shoal of fishes. A continual stream of birds drop into the water which is kept in constant agitation while after each dive the bird returns to the flock in the air thus maintaining the circulation.

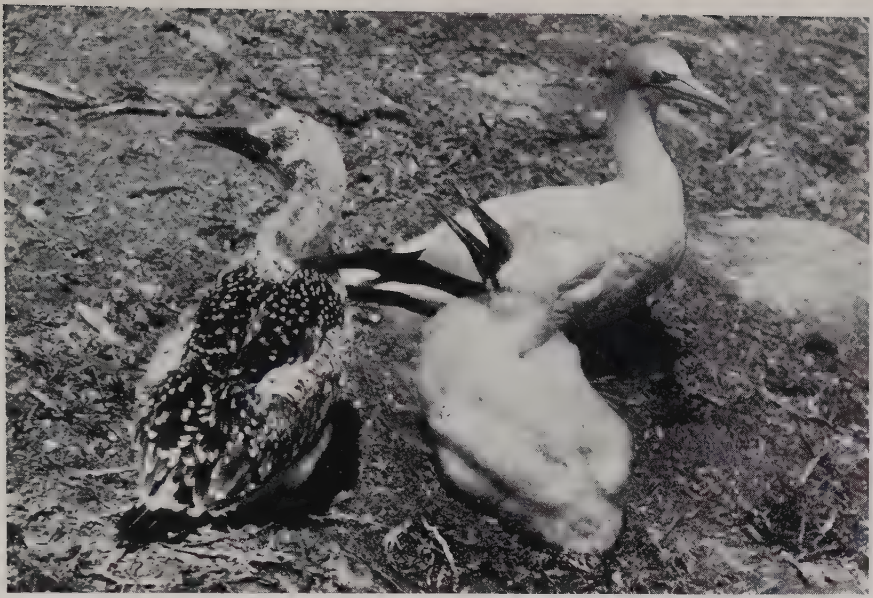
Nesting. Cape Kidnappers. The best known colony of gannets in New Zealand is that at Cape Kidnappers. It is isolated by rough country but is accessible from the nearest road, five miles distant, by a hard sandy beach. The colony is placed on a narrow tapering sandstone headland which juts in an east-north-easterly direction into the ocean. Weathering of the soft rock has cut away the sides of the headland into precipitous faces so that all the nests of the main colony are placed on the top which is in the form of a basin. On the higher ground inland of the pinnacles there was a colony of about 80 nests in January, 1947, evidently the overflow of the colony on the headland.

Most birds arrive from the sea in August, but many arrive in July and sometimes a few in June. All the birds appear to be in mature plumage. The nests are placed in ranks and are almost equidistant. They are as close as is compatible with the keeping of good relations in the community. In other words each bird is just beyond the pecking distance of its neighbours.

The nests are placed on small mounds of guano and earth with centres about two and a half feet apart. Each mound is about two feet across and has a nesting hollow about nine inches in diameter. On level ground they are about six inches high, but on sloping ground the lower side may be eight, ten or more inches high thus bringing the rim of the nest to a horizontal position.

The mounds are composed of compacted earth, guano and seaweed, added to each year by guano and seaweed and probably raised further by a washing away in the surrounding channels by rain water. The nest is often well formed of seaweed, mostly the common brown species of *Carpophyllum.* But the birds bring quantities of grass as well, green grass plucked up by the roots was seen. The earth contained in the nest mounds is probably blown on and serves to cement the rotting seaweed together. Each season more seaweed and grass is added to the mound. Most eggs are laid from mid-September to the end of October. There is no evidence to show that gannets lay twice in a season but there are a number of early and late layers and so eggs and young in all stages are usually seen in the breeding colonies at the same time. Both parents take part in incubating the egg which they cover with their webbed feet, the two webs meeting over the egg. Only one egg is laid. At first it is white, but its rough outer limy layer soon absorbs dirt and blood and so it becomes stained all over. Wodzicki and Robertson give the incubation period as 43-47 days. Most young are hatched in November and December.

The ceremonies of birds in a breeding colony are interesting to watch though it is not easy to guess their meaning. When a bird lands there may be what looks like a greeting ceremony. The pair face one another with breasts touching and heads stretched upwards. There is mutual rubbing of necks, wagging of heads from side to side and preening each other with their bills. The most common action seemed to me one of warning to keep away as when a bird is landing or it may be an expression of contentment. The bird on the ground stands up with wings partly folded and lowered. Then follows bowing of the body and lowering the head under the wing on the right or left



Mahuki, Great Barrier Island *C. A. Fleming*

GANNET NESTLING. IMMATURE AND ADULT

side. These performances are accompanied by a half whistling and half croaking sound. Often two birds will act thus towards one another. This dance stimulates other birds to perform in the same way.

White Island. The colonies of gannets on White Island are grouped in three localities. On December 7th, 1912, that is about two years before the eruption, I visited the colonies at Gannet Point on the south coast nearest the crater. The nesting area was clear of vegetation except for a growth of succulent herbaceous plants in parts unoccupied by nests. The nests were low crater-like mounds of earth and guano of former years' accumulation lined more or less with seaweed, mostly *Carpophyllum maschalocarpum* and *Cystophora retroflexa,* with, in most cases, stalks of *Chenopodium allanii.* I doubt whether the birds do more towards making the nest than collecting *Chenopodium* and seaweed for it. The mound is built up by the arrest of wind-blown earth, its cementing by guano and the deepening of the area between the nests by rain wash. This colony contained mostly fresh eggs, though in many cases incubation had begun and there were a few chicks. Another colony, at Rocky Point, visited the following day, contained mostly young birds just hatched though there were also fresh eggs and large downy chicks. Evidently, therefore, each colony behaves as a separate unit with characteristics of its own. The presence of dead pohutukawa plants (*Metrosideros excelsa*) in the midst of this colony as well as round the edge shows that the birds not only prevent the scrub from spreading but actually kill these stunted trees.

White Island was visited in January 8-14, 1947, by a Government expedition and a report on the gannets was made by Robertson and Wodzicki. Although this was a month later in the season than my visit there were more than ten times as many eggs as chicks in one of the colonies. This result and my own observations show that the egg-laying period here is more than a month later than it is at Cape Kidnappers.

Records from various localities show that egg laying takes place from August to December. The indications are, however, that different colonies or sections of colonies lay their eggs at different times. Thus would be explained the reports of finding groups of eggs or young at different stages of development at the same time in the same or different colonies.

The gannet when first hatched is an unlovely naked black chick, whose shiny skin and limp body remind one of nothing else than a reptile. Almost immediately the down begins to sprout and in about ten days the chick is covered with a soft pure white layer. The down is practically all shed when the chick is two months old, but according to Mr. D. G. Williams, one-time ranger at Cape Kidnappers, the young do not leave until about four and a half months old, the bulk departing in March. Late hatched young may be seen in April or, very rarely, in May. The feeding of the young is an interesting process. The chick puts its bill into the parent's mouth, rotates it 90 degrees, opens it as wide as possible, and thus placed pushes backwards and forwards as the parent regurgitates food into it. The chick's wings are more or less spread while this is going on.

Before rising the gannet sometimes disgorges the contents of its stomach. Even naked chicks just hatched endeavour, when approached, to throw up their food. Here is a case of instinct appearing so early as to be disadvantageous, for though it may be necessary for the adult to relieve itself of its load in order to rise quickly, it is incredible that it is of any benefit to the young to lose a meal.

References.—Gray, Zool. Erebus and Terror, Birds, 19, 1845 (*Sula serrator,* Tasmania). Buller, Birds N.Z., 323, 1873; 2nd ed., 2, 177, 1888; Suppl., 2, 46, 1905. Cottrell, Emu, 23, 101, 1923. Mathews and Iredale, Man. Birds Austr., 1, 76, 1921 (*Sulita serrator rex,* New Zealand). Oliver, Emu, 13, 88, 1913 (White Id.). Wodzicki and McMeekan, Trans. Roy. Soc. N.Z., 76, 429, 1947 (Cape Kidnappers). Buddle, N.Z. Bird Notes, 2, 129, 1947 (Three Kings). Fleming and Cunningham, N.Z. Bird Notes, 2, 109, 1947 (Hauraki Gulf). Robertson and Wodzicki, N.Z. Bird Notes, 3, 38, 1948 (White Id.). Buddle, Bird Secrets, 49, 1951. Fleming and Wodzicki, Notornis, 5, 39, 1952. Wodzicki and Robertson, Emu, 53, 152, 1953 (Cape Kidnappers). Stein and Wodzicki, Notornis, 6, 58, 1955.

Genus Sula

Bill stout, conical, cutting edge of upper mandible sharply serrate in front; culminicorn longer than anterior portion of latericorn. Feathering on the throat truncate, with entire margin and not extending into the interramal space. Tail of 12-18 feathers. Front toes reticulate, hind toe scutellate.

This genus which comprises the tropical Boobies is distinguished from the Gannets (*Morus*) chiefly by the feathering on the throat not extending into the interramal space and the front toes being reticulate.

Six species are distributed over the tropical and sub-tropical regions of the world. In the New Zealand region one species breeds in the Kermadec Group, another is a straggler to the North Island.

Key to New Zealand Species

Upper surface white	*S. dactylatra*
Upper surface sooty brown	*S. leucogaster*

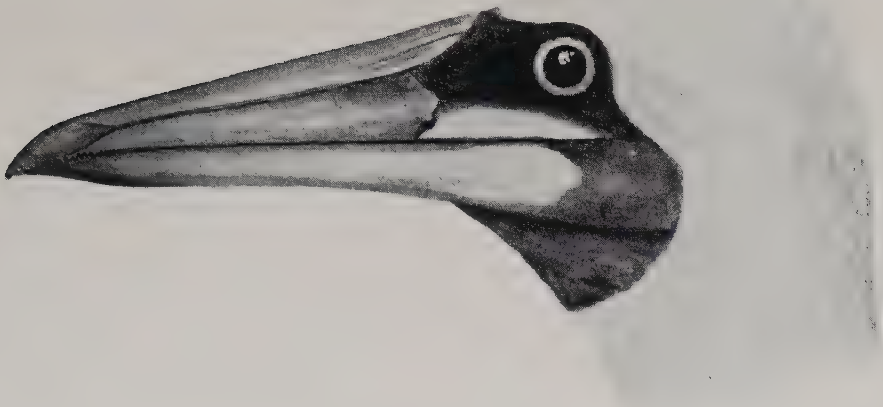
Reference.—Brisson, Orn., 6, 494, 1760 (*Sula* type *Pelecanus leucogaster,* Bodd.).

Masked Gannet Blue-faced Booby

Sula dactylatra personata

The common tropical species is, in the New Zealand region, found only at the Kermadecs. Little collecting was done in the group until after Cheeseman's visit in 1887, when the present species was observed breeding on Curtis Island. The following year Captain Fairchild brought to Auckland four live specimens, the first that, so far as has been recorded, were obtained from this group.

Adult. White; primaries and secondaries and their coverts, and tail feathers brownish black. Tail of 16 to 18 feathers. Bill greenish yellow. Iris dark brown. Naked skin on face and throat bluish black. Feet greenish grey, yellowish on webs. Bill 100-113, wing 445-470, tail 184-197, tarsus 55-56, mid toe 97-100 mm. *Immature.* Head, back and wing coverts greyish brown with white mottling; quills and tail black; under wing brown, the front margin white; remainder of body white. Bill greenish yellow, darker towards the base. Meyer Island.



C. McCann

MASKED GANNET

Nestling. Covered with long white down. Bill blackish. Feet whitish. Meyer Island.

Eggs. Clutch two, elliptic, blunt-pointed at both ends, pale bluish with thick white chalky outside layer, 64 x 48.5, 64 x 46.5 mm. Curtis Id.: 70 x 46, 48.5 x 45 mm. Herald Islets.

Status. The distinguishing characteristics of the subspecies *personata* are the stout yellow bill and greenish blue feet. Six subspecies have been defined mainly on the characters of the bill and feet.

Meyer Island *W. R. B. Oliver*

MASKED GANNET, NESTLING

Distribution. Kermadec Islands; breeding on the Herald Islets and on Macauley and Curtis Islands.

North Queensland to Lord Howe and Norfolk Islands.

The species ranges over the coastal waters and islands of the tropical and subtropical Atlantic, Indian and Pacific Oceans.

Food. The food of the Blue-faced Booby is mainly flying fish.

Nesting. In the Kermadec Islands the nest consists only of a slight hollow in the ground. Eggs are to be found from late August until November, two being the usual number laid but only one young is hatched. Mr. R. S. Bell, a very careful observer, informs me that both eggs are incubated but on the first chick being hatched the mother pushes the other egg from the nest. The photograph of the young bird reproduced herewith was taken on February 29th. This individual was still on Meyer Island on April 24th fully fledged and able to fly.

On Curtis Island on November 12th, I found four eggs in one nest but they were of two different sizes and presumably laid by two birds.

References.—Lesson, Trait. Orn., 8, 601, 1831 (*Sula dactylatra,* Ascension Island). Gould, Proc. Zool. Soc., 1848, p. 21 (*Sula personata,* Raine Id.).

Brown Booby
Sula leucogaster plotus

Not more than four occurrences of the Brown Booby within the New Zealand region have been recorded. The first specimen was shot at Napier in 1888 and was recorded by A. Hamilton.

Adult. Head, neck and upper surface sooty brown; breast and remainder of under surface white. Tail of 14 feathers. Bill yellow or greenish white. Iris silver grey. Naked skin on face and gular pouch, yellowish or bluish. Feet pale yellow. Bill 84-90, wing 374-380, tail 195-200, tarsus 43-45 mm. *Immature.* Differs from the adult in having the head, neck, chest and upper surface lighter than in the adult; breast and remainder of the under surface still paler brown; the feathers edged with whitish. *Nestling.* Covered with whitish down.

Eggs. Clutch two, bluish white with a chalky layer, 58 x 41 mm. (av.)

Status. Five subspecies of this widely-ranging species are recognised. The western Pacific form (*S. l. plotus*) is larger and of a deeper brown than the typical form (*S. l. leucogaster*) from the Atlantic. There are two subspecies on the west coast of America and one in the eastern Indian Ocean.

Distribution. Four occurrences. Raoul Island. Bay of Islands. Horuhoru. Napier. The Horuhoru bird wintered in New Zealand with the ordinary gannets.

Western Pacific Ocean.

Habits. On Willis Island the Brown Booby constructs nests on the grassed portion of the island, consisting of pieces of coral and twigs laid loosely on the grass. The young are born blind and naked but soon acquire a coat of white down. According to MacGillivray, in the Capricorn Group, "although two newly-hatched young birds were frequently seen, only one usually was reared to the downy stage." The food of the Brown Booby consists mainly of flying fish.

References.—Boddaert, Tabl. Pl. Enlum., 57, 1783 (*Pelecanus leucogaster,* Cayenne). Hamilton, Trans. N.Z. Inst., 21, 128, 1889 (*S. fusca*). Stein, Notornis, 4, 213, 1952; 5, 165, 1953.

Curtis Island *W. R. B. Oliver*

MASKED GANNET

ORDER CHARADRIIFORMES

WADERS

Bill slender with long nasal grooves. Primaries 11. Lower portion of tibia bare. Toes not webbed or partially webbed (fully webbed in Recurvirostra). Young hatched with down and able to run shortly after being hatched.

The waders are closely allied to the gulls and terns. The most obvious differences are the slender bill and small webs to the toes.

Key to New Zealand Families

Bill long, not decurved at tip.
  Bill much compressed at tip .... *Haematopodidae*
  Bill not compressed at tip.
    Bill moderately stout; interramal space and nasal depression rounded in front .... *Charadriidae*
    Bill slender; interramal space and nasal depression pointed in front.
      Tarsi scutellate in front.
        Toes without scalloped webs .... *Scolopacidae*
        Toes with scalloped webs .... *Phalaropodidae*
      Tarsi reticulate in front .... *Recurvirostridae*
Bill short, decurved at tip .... *Glareolidae*

FAMILY HAEMATOPODIDAE
OYSTERCATCHERS

Bill stout, both mandibles much compressed at the tip. Tarsus reticulated both in front and behind. No hind toe.

A single genus.

Genus Haematopus

Angle of gonys near base of bill; interramal space wide. Front toes connected by a web at the base, and margined by a web for their entire length on each side. A cosmopolitan genus of about six species.

Key to the New Zealand Species

Abdomen white.
  Smaller, lower back white .... *H. ostralegus*
  Larger, lower back black .... *H. longirostris*
Entirely black .... *H. unicolor*

New Zealand ornithologists are in no way agreed about the number of species of oystercatcher that should be recognised in New Zealand, about the limits of the forms and what their status and names should be. According to my views there are present in the country (1) a smaller pied migratory species; (2) a larger pied non-migratory species; (3) a black non-migratory species; and (4) birds with plumage intermediate between (2) and (3). In 1939 Falla published a paper in which he recognised the smaller pied form as a species; the black birds he divided between a species, *unicolor,* and the black phase of his *reischeki*; and the large pied birds were assigned partly to a separate species, *chathamensis,* and partly to the pied phase of his *reischeki. H. reischeki* according to Falla included forms which commonly interbreed when found in the same breeding area whether black, pied, or those intermediate in colour between them. I am, however, unable to accept Falla's classification as I maintain that the end points of evolution in *Haematopus* in New Zealand, those which should bear the species names, are the small pied (*ostralegus*), the large pied (*longirostris*), and the black (*unicolor*) forms, those birds of mixed plumage being hybrids between the large pied and the black species. Further, Falla's classification is untenable because no one has been able to show that there are two forms of Black Oystercatcher in New Zealand, or that the Chatham Island Pied Oystercatcher is different from the North Island Pied Oystercatcher. Fleming compared Chatham Island birds with the South Island Pied Oystercatcher and naturally found differences, the same differences as would be found by comparing North Island and South Island Pied Oystercatchers. The two pied oystercatchers, that is, *ostralegus* and *longirostris,* do not interbreed although in the breeding season they probably come together in northern Nelson. The North Island Pied Oystercatcher, including Chatham Island birds, I refer to *H. longirostris.* In the following account I am, therefore, disregarding Falla's conclusions except for the recognition of two species of pied oystercatcher, and am classifying the New Zealand forms according to the views stated above.

Reference.—Linne, Syst. Nat., 10th ed., 152, 1758 (*Haematopus,* type *H. ostralegus,* L.)

South Island Pied Oystercatcher. Torea
Haematopus ostralegus finschi

It is hardly possible to say to which of the two New Zealand species of pied oystercatchers the birds recorded by the early visitors to New Zealand should be referred, but probably the "Pied Oistercatcher" recorded by Latham in 1785 as from New Zealand belonged to this species. The specimen would be collected by one of Cook's expeditions. Dieffenbach also probably referred to the present species when about 1840 he reported it as common in New Zealand. It was not until 1897 that it was given a distinctive name by Martens and his type specimen, at that time in the Hamburg Museum, came from Saltwater Creek, near Timaru.

Adult.—Head, neck, upper back and breast glossy black; lower back, rump and upper tail coverts white, the terminal coverts having irregular black tips; wings above black, the primary coverts grey terminally and the secondary greater coverts white. Primaries, except the first, with patches of white at the base of the inner webs increasing in size proximally until at least two secondaries are pure white. Tail black. Under surface, behind a rather sharp line of demarcation on the breast, white, except the quill feathers which are black. Bill reddish orange. Iris scarlet, eyelid orange. Feet pink. Bill 70-96, wing 243-260, tail 92-104, tarsus 46-56, mid toe 36-40 mm. The female is slightly larger and has a longer bill. *Immature.* Similar to the adult but the dark parts suffused with brown; scapulars and upper wing coverts edged with buff. *Nestling.* Above buffy grey with the tips of the down whitish buff; an irregular longitudinal band on the crown, narrow line through eye, two parallel bands along the back, and a bar on the thigh, blackish. Under surface from lower breast white. Bill brown, yellow at base. Iris brown. Feet brown. *Colour varieties.* At Ettrick in Otago an albino was seen on several occasions. Another was seen in the Firth of Thames on February 8, 1942. In May 1944 Sibson reported that evidently the same bird began to change colour and by August the head to the lower chest was coloured as in normal *finschi* but the remainder of the plumage was white. An albino almost pure white except on the wings was seen by Falla at the mouth of the Waimakariri River. A white bird with a light fawn head was seen by Mrs. I. Tily and Mrs. L. E. Walker near the entrance to Otago Harbour.

Eggs. Clutch two, ovoid, brownish stone with dark and pale brown blotches all over. 54 x 39.4, 59.2 x 38.8 mm. Waimakariri River.

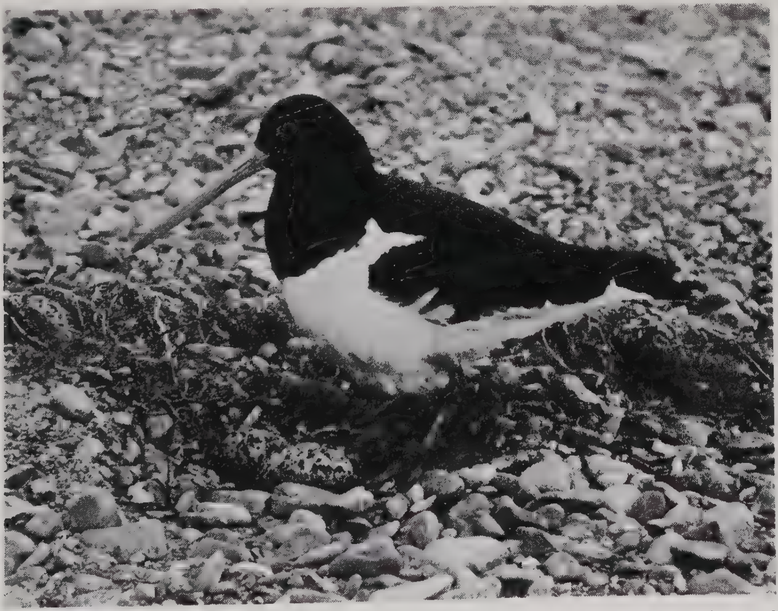
Status. The pied oystercatchers with black backs are represented in the northern hemisphere by *ostralegus* and its allies characterised by a definite white pattern on the outer half of the primaries. In the pied oystercatchers of the southern hemisphere, namely, *H. o. finschi, H. longirostris* and *H. leucopodus,* there is no similar white colour pattern on the primaries. *H. o. finschi* is similar to *H. longirostris* differing in its slightly smaller size, in the breast line being more sharply defined, and especially in the white of the upper surface extending well over the lower back. The white alar bar is also wider. Furthermore, *finschi* is migratory and does not mate with *unicolor*.

Distribution. South Island, abundant and breeding. Stewart Island, not common. Partially migrating to the North Island in summer and remaining there throughout the winter. They are to be seen in fair numbers as far north as Kaipara Harbour, and in small numbers in Parengarenga Harbour. In the Manukau Harbour and Firth of Thames, Sibson, McKenzie and others have kept a close watch for many years, and report arrivals from the South Island beginning in early January and reaching their peak in April. The return journey takes place in August and September, except for some apparently first year birds that stay for another winter. Marples has recorded the South Island Pied Oystercatcher wintering on the coast near Dunedin.

Habitat. During the breeding season the South Island Pied Oystercatcher resorts to the river beds, sometimes following their courses far into the Southern Alps. It also breeds in other stations including the top of some of the ranges in Central Otago. After the breeding season the birds congregate on the coasts where they winter, but a proportion migrates to the northern part of the North Island where they are to be found along sandy shores and on the intertidal sand and mud flats of harbours like Manukau and Kaipara. At high tide they rest on sand and shell banks near the water's edge.

Food. The Pied Oystercatcher feeds mainly on small animals, worms, crustacea and molluscs, which it finds on intertidal beaches and flats. Falla records that young birds had been fed on beetle larvae, flies and small fishes.

Nesting. Potts was the first ornithologist to describe the nesting habit of the South Island Pied Oystercatcher. He says: "Usually it breeds in our river beds, on the sandy spits, without other shelter than what may be afforded by some drift flax, grass,



North Canterbury *K. V. Bigwood*

SOUTH ISLAND PIED OYSTERCATCHER

or stick, near which it makes, or discovers, a slight depression, in which to deposit its eggs. . . . Usually three eggs are laid, but we have found it incubating a single egg. . . . It is found breeding in solitary couples, often far inland, . . . for instance, up the Wilberforce River, nearly as far back as the neighbourhood of Browning's Pass." Further details regarding the breeding habits of this species are recorded by Falla. He states that the breeding season commences in August when the pairs occupy their nesting grounds which are some miles apart. The normal clutch is two, and fresh eggs have been found in October and November. "Early September is, however, the normal laying time for this oystercatcher, and in the 1938 season most of the season's young were old enough to find places of safety when early November floods swept away whole colonies of gulls and tern."

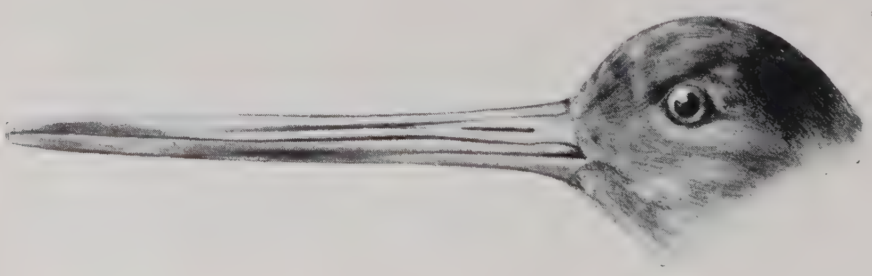
References.—Linne, Syst. Nat., ed. X, 152, 1758 (*Haematopus ostralegus,* Sweden); Potts, Trans. N.Z. Ins., 2, 69, 1870; N.Z. Jour. Sci., 2, 510, 1885. Buller, Birds N.Z., 223, 1872; 2nd ed., 2, 16, 1888. Martens, Orn. Monat., 5, 190, 1897 (*H. finschi,* Saltwater Creek), 14, 90, 1906. Sibson, N.Z. Bird Notes, 1, 107, 1945.

North Island Pied Oystercatcher
Haematopus longirostris chathamensis
(semispecies)

I have not come across any definite early records of pied oystercatchers from the North Island. The species was collected at the Chatham Islands by H. H. Travers in 1871.

Adult. Head, neck and breast black with greenish reflections; back and wings brownish black; inner webs of primaries with grey areas, outer webs of secondaries mainly white; rump and tail coverts white, the upper limits being mottled. Tail brownish black. Under surface from breast white, the line of demarcation between black and white not sharply marked, there being a band of mottled feathers. Bill 69-89, wing 264-275, tail 98-106, tarsus 50-62, mid toe 42-46 mm. Colours of unfeathered parts of bird of mixed plumage recorded by Falla: Bill orange with yellow tip, iris scarlet, eyelid deep orange, feet rose pink. The females are slightly larger and have longer bills. *Immature.* Similar to the adult except that the back and wing coverts are dark brown with whitish edges to the feathers, the rump is mottled white and brown, and the breast has a wide mottled band at the junction of the black and the white areas. *Nestling.* Progeny of black and mixed plumage birds recorded by Brathwaite: Brownish grey with black markings, under parts white. *Colour variety.* According to Buller a pure white Oystercatcher was several times seen by Major Mair on the beach at Opotiki. It could have belonged to this species or *finschi.*

Hybrids. In the North Island and the northern portion of the South Island there occur oystercatchers in which the distribution of the black and white is intermediate between that of the black and the pied forms. There is no fixed pattern, every individual being differently marked. The area in which these birds of mixed plumage occur coincides with that region where the distribution areas of the Black Oystercatcher


Lily A. Daff

NORTH ISLAND PIED OYSTERCATCHER

and the North Island Pied Oystercatcher overlap. We thus have here two of the essential criteria of hybridism, and a simple explanation of the origin of the birds of mixed plumage. In 1897 Martens gave the name *reischeki* to a bird of mixed plumage and this name has been used by Falla to cover, as a single species, these mixed plumage birds together with the black ones and the pied ones that associated with them. This scheme seems to me, besides being impracticable to apply and confusing, zoologically untenable because birds of the black and of the pied forms keep true to their characters in those areas where only one kind exists, namely, the black form (*unicolor*) in the South Island and the pied form in the Chatham Islands. Both of these species are non-migratory and this fact explains why the birds of mixed plumage are found only where there is an overlapping of the areas of distribution of the two species.

On King Island, Bass Strait, the Pied Oystercatcher and the Black Oystercatcher, both apparently subspecifically distinct from their congeners in New Zealand, are said by A. J. Campbell to co-mingle and hybrids, the progeny of the two species, are known. There is, however, no recent confirmation of this statement.

In connection with the hybrids it is of interest to note that the progeny of black birds and those of mixed plumage predominately black, may be normal birds of both the black and the pied species. Such a case has been recorded by Falla at Waikuku Beach, near North Cape, while Brathwaite at Waikanae has recorded young birds having much more white on the under surface than either of the parents. There are in these two cases clear indications that the parents were descended from birds which included normal or near normal pied forms.

Status. I have compared specimens of the pied oystercatchers from New South Wales, the North Island of New Zealand and the Chatham Islands and can find no differences of any importance. I am therefore including them all under one species, the earliest name for which is *longirostris*. The extent of white on the lower back seems to be a variable character even in New Zealand birds, while Australian birds have rather more white on the back than have New Zealand birds, and the dividing line on the breast is more clearly marked. The two forms can accordingly be treated as separate subspecies, the New Zealand one taking the name *chathamensis,* the only name that has been applied to it. As the breeding areas of the two New Zealand kinds of pied oystercatchers overlap in the northern portion of the South Island without cross breeding it must be conceded that they belong to different species.

Distribution. North Island and northern and western portions of the South Island. Great Barrier Island. Kapiti Island. Reported in South Island from Marlborough Sounds, Kaikoura, Westland and Fiordland. Chatham Islands. Not common but most frequent north of Auckland. The typical subspecies, *H. longirostris longirostris,* is found throughout Australia and Tasmania.

Habits. The North Island Pied Oystercatcher is found mainly on sandy beaches and coastal sand dunes. In the Chatham Islands, according to Fleming, it resorts almost entirely to rocky shores. It breeds later than its South Island relative *finschi,* and it does not resort to river beds inland to lay its eggs. Eggs have been recorded from October 22nd to January 4th. Chicks of hybrid origin observed by Brathwaite at Waikanae were thought to have been hatched about December 21st and the young were fully fledged on February 11th. In the far north, according to Falla, *H. reischeki,* under which name he includes the black and the pied forms as well as those of mixed plumage, in this instance probably referring to the North Island Pied Oystercatcher, "is less suspicious and wary than either *H. finschi* or *H. unicolor* and the nests of neighbouring pairs may be fairly close without active rivalry being shown. The nests are

G. A. Buddle

NORTH ISLAND PIED OYSTERCATCHER

hollows in sand close to high water mark, and often near conspicuous pieces of driftwood or masses of dried kelp."

References.—Vieillot, Nouv. Dict. Hist. Nat., 15, 410, 1817 (*H. longirostris,* New South Wales). Hartert, Nov. Zool., 34, 17, 1927 (*H. chathamensis,* Chatham Is.) Fleming, Emu, 38, 494, 1939. Falla Rec. Cant. Mus., 4, 263, 265, 1939. Brathwaite Notornis, 4, 22, 1950. Buddle, Bird Secrets, 46, 1951.

Black Oystercatcher. Torea-pango

Haematopus unicolor unicolor
(semispecies)

The Black Oystercatcher was first met with by Forster at Dusky Sound in 1773 during Cook's second voyage. He saw it in flocks on the rocks, feeding on insects, crabs and shellfish. Although Forster's decription was not published until 1844, it was the first that appeared. The species was not again observed, or at least placed on record, until nearly seventy years after Forster discovered it. In 1841, Colenso found it to be common in Tokomaru Bay, and about the same time Percy Earl collected a specimen and forwarded it to the British Museum.

Adult. Entirely sooty black; the primaries and secondaries sooty brown; lower surface of tail brown. Bill coral red. Iris scarlet, eyelids orange. Feet purplish pink, claws brown. Palliser Bay. Bill 76-93, wing 260-277, tail 96-110, tarsus 50-70, mid toe 40-51 mm. The females are on an average larger than the males and have longer more pointed bills. *Immature.* Blackish brown, the feathers edged with pale buff, widest on the back and wings, very narrow on the head and breast. Bill and feet dull red. *Nestling.* Grey with dark blotches all over. Bill and feet dull brown.

Hybrids. Where the Black Oystercatcher meets the North Island Pied Oystercatcher birds of intermediate colour patterns appear. In my opinion these birds of mixed plumage are best treated as hybrids between two species (semispecies). This question is discussed under the North Island Pied Oystercatcher.

Eggs. Clutch usually two or three, ovoidoconical, stone colour to pale yellowish brown marked all over but mainly at the larger end with blackish brown and purplish blotches and spots. 57 x 40, 58 x 41 mm. Otago. 59 x 41 mm. Rangitikei Beach.

Status. I regard all the black oystercatchers found in New Zealand as comprising a single species. It is closely related to *H. fuliginosus* of Australia and *H. moquini* of South Africa. If it were thought advisable to treat these as subspecies of a single species, the specific name would be *unicolor.*

Distribution. North Island as far north as Parengarenga, Great and Little Barrier Islands, Kapiti Island. D'Urville Island. South Island. Stewart Island. Said formerly to have been present on the Chatham Islands. Breeds in Stewart Island, South Island, east coast of North Island, and west coast of Wellington. The Black Oystercatcher is a coastal species but it has been recorded from a few inland localities, namely, near Lakes Brunner and Guyon and "far inland" in Marlborough. It was probably more common inland before the advent of European settlement.

Habitat. The Black Oystercatcher is

L. E. Richdale

BLACK OYSTERCATCHER

generally distributed along the coasts, especially on rocky shores and the adjoining sandy beaches, and on mudflats in harbours and estuaries. It has also been recorded on river beds in a few inland localities.

Food. The Black Oystercatcher feeds on intertidal sandy beaches and sand and mud flats in harbours. It thrusts its long beak into the sand and brings to the surface pipis which, Mr. H. J. Toye informs me, it holds on the sand with one foot and opens the shell very quickly with its beak. It feeds also on other small animals, such as crustacea and worms, which it seeks in the sand or mud or under stones.

Nesting. The Black Oystercatcher likes its nest to be at some distance from its neighbours so the breeding pairs are somewhat isolated. The nest is a mere depression above high tide mark in sand or shingle. There is often a little nesting material such as small pieces of sticks or leaves. At Port Pegasus Richdale found a nest lined with shells. Laying takes place in October, November and December and the young leave the nest shortly after hatching. On being disturbed when eggs or young are in the vicinity the Oystercatcher feigns lameness in order to draw intruders away from its nest or offspring. The young follow their parents until they are fully fledged.

References.—Forster, Desc. Anim., 112, 1844 (*H. unicolor,* Dusky Sound). Gray, Zool. Erebus and Terror, Birds, 12, col pl., 1845. Buller, Birds N.Z., 225, 1872; 2nd ed., 2, 18, 1888. Falla, Rec. Cant. Mus., 4, 265, 1939.

FAMILY CHARADRIIDAE
TURNSTONES, PLOVERS

Bill pointed, shorter than tarsus, the lower mandible upturned towards the tip; interramal space and nasal grooves relatively broad and rounded anteriorly.

As thus defined this family includes the Turnstones, true Plovers and Masked Plovers. There is no essential difference in the bills, which, however, contrast markedly with the slender, more compressed bill of members of the Family Scolopacidae.

Generic standards in the plovers have fluctuated a good deal since the first edition of this book was issued. All ornithologists will agree that the number of genera proposed for the plovers and dotterels needs drastic reduction. However, the short billed dotterels with brown or grey upper plumage, white under surface and usually black face and chest markings should be separated from the longer billed (in relation to mid toe) plovers spotted above and, in breeding plumage, black below. The New Zealand dotterel occupies a middle position. It agrees with the plovers in its long bill and absence of face and chest markings but differs in the type of coloration, the plumage more resembling that of the smaller dotterels but with more spotted appearance. On account of its long stout bill I include it with the plovers.

Key to New Zealand Genera

- Bill without a dertrum; hind toe well developed .... *Arenaria*
- Bill with a dertrum; hind toe mostly absent (well developed in *Lobibyx*)
  - Hind toe absent or very small; tarsus reticulate.
    - Bill straight.
      - Dertrum well developed; bill much shorter than tarsus.
        - Bill about equal to middle toe .... *Pluvialis*
        - Bill about three-fourths of middle toe .... *Charadrius*
      - Dertrum very short and low; bill about equal to tarsus .... *Thirnornis*
    - Bill deflected to right .... *Anarhynchus*
  - Hind toe well developed; tarsus scutellate in front .... *Lobibyx*

GENUS ARENARIA

Bill conical, sharp-pointed, without a dertrum; interramal space broad and short. Tarsus scutellate in front and partly so behind. Hind toe well developed, elevated.

The best distinguishing characters are the conical bill with short interramal space, and the scutellate tarsi. Two species, one cosmopolitan, the other confined to the west coast of North America.

The skull of Arenaria has been shown by Lowe to contain certain features, in particular the absence of a maxillo-palatine strut, similar to those found in the Scolopacidae. In the characters of the bill and pattern of coloration, however, the turnstones are allied closely to the plovers, and this should be considered more important for determining their taxonomic position than the internal skull characteristics mentioned by Lowe. The absence of a strut may be a primitive feature retained by a genus of waders which in other respects has become more specialised than the Scolopacidae. Lowe says that the species of Arenaria are "specialised Eroliines." It may well be that this epithet could be applied to all members of the Charadriidae.

Reference.—Brisson, Orn., 5, 132, 1760 (*Arenaria,* type *Tringa interpres,* L.)

Turnstone

Arenaria interpres interpres

This cosmopolitan species, a southern summer visitor from the northern hemisphere, was first noticed in Canterbury in 1871, several specimens in winter plumage being taken in that year on the Ninety-mile Beach. A specimen in summer plumage was shot at Silverdale on April 1st, 1872, and another in partial summer plumage was taken at Invercargill in March, 1873.

Adult—Summer Plumage. Base of forehead and frontal line black, followed by a band of white extending over the ear coverts; crown and hind neck white mottled with black; lores white; a patch below the eye black. General colour above, black mixed with chestnut; lower back and rump white; upper tail coverts black, the longer ones white; tail feathers black with white bases, all except the two central ones tipped with white; lesser wing coverts blackish, median coverts chestnut, greater coverts blackish tipped with white; primaries black; secondaries white, blackish towards the ends, the innermost black mottled with chestnut. Throat white; sides of neck, foreneck and upper chest black; rest of under surface white. Bill black. Iris brown. Feet orange-red, claws brown. Bill 20-23, wing 140-160, tail 57-68, tarsus 23-25.5, mid toe 20-24 mm. The female is duller than the male and with less chestnut on the back. *Adult—Winter Plumage.* Differs from the summer plumage in the absence of chestnut on the upper surface, it being replaced by dark brown, with pale margins to the feathers; head and hind neck brown, mottled with whitish. The black of the foreneck and chest much broken by whitish tips to the feathers. Most of the birds taken in New Zealand have been in the winter plumage, but towards the end of summer a proportion have assumed the summer garb. *Immature.* Similar to the adult in winter plumage, but margins to the feathers of the upper surface buff. *Nestling.* Pale greyish brown, yellowish on the head, heavily mottled or broadly striped with black. Under surface white with indistinct band across chest.

Eggs. Clutch four, pale green, closely marked all over with irregular light and dark olive-brown markings, 37 x 27, 40 x 28.6, 42 x 29, 43.1 x 30 mm. New Siberia.

Status. The American breeding birds and the Euro-Asiatic breeding birds are classed as two subspecies comprising the species *interpres.* The eastern hemisphere subspecies, *A. interpres interpres,* is darker than the western hemisphere subspecies, *A. i. morinella,* and has black predominating on the upper surface, whereas in the American subspecies the predominant colours of the upper surface are chestnut and white.

Distribution. North and South Islands as far south as Lake Ellesmere in Canterbury and Invercargill in Southland; not uncommon in suitable localities. Turbott records large numbers in Parengarenga Harbour. Straggler to Auckland Islands. In New Zealand the Turnstone begins to arrive in September. It is most abundant from September to March, when it begins to leave the country. Stray birds have been seen as late as the end of May. The birds which visit New Zealand are presumed to breed in Eastern Siberia. Some birds remain in New Zealand throughout the winter.

The Eastern Turnstone breeds in the Arctic regions of Europe and Asia. It arrives in high northern latitudes during the latter part of May and beginning of June and leaves again during the first half of August. At the end of the northern summer it migrates as far south as South Africa, Australia and New Zealand.

Habitat. Sea beaches, sand and mud flats in inlets and estuaries, and freshwater lakes not far from the coast are the stations most frequented by Turnstones. A close watch has for several years been kept on the Puketutu district of Manukau Harbour by R. B. Sibson and other local ornithologists and it has been found that certain areas are regularly visited by Turnstones. They associate chiefly with Golden Plover, the two species being often found together. Turnstones arrive in Manukau Harbour singly or in small flocks from mid-September onwards. "It seems clear," writes Sibson, "that most of our Turnstones and Golden Plover after arriving move south." From January to March flocks of 60 to 80 birds may be seen. Buller quotes Cheeseman as stating that in March, 1880, in the Manukau Harbour, he met a flock of upwards of a thousand Turnstones.

Food. Small animals found under stones, pieces of wood and storm cast seaweed, and also those living beneath the surface of intertidal mud and sand flats and sandy beaches form the principal food of the Turnstone. A vivid description of the feeding habits of the American subspecies has been published by F. T. Noble who says that the birds go to work with a vim and rapidity entirely different from other species. "Underneath the bits of weed, moss, and fragments of shell his sharp upturned bill would swiftly go and a perfect shower of these would soon be falling in front and beside him."

Nesting. In the New Siberian Archipelago nests are for the most part slight hollows between tufts of moss, sometimes lined with grass or reindeer hair. The eggs are laid in June very shortly after the birds arrive, and both adults and young leave as soon as the young are strong on the wing, only about two months being spent at the breeding grounds.

References.—Linne Syst. Nat., 10th ed., 148, 1758 (*Tringa interpres,* Europe). Buller, Birds N.Z., 221, 1872; 2nd ed., 2, 14, 1888. Pleske, Mem. Bost. Soc. Nat. Hist. 6, 227, 1928. Sibson N.Z. Bird Notes, 2, 4, 1946.

GENUS PLUVIALIS

Bill about equal to middle toe and claw. Tarsi reticulate, much longer than bill. Hallux absent or minute.

Three species breeding in the northern hemisphere and during the northern winter migrating southward, one to northern Africa, the others to the southern hemisphere. One non-migratory species in New Zealand.

Key to New Zealand Species

Conspicuously spotted above, under surface black in summer
  Small hind toe present .... *P. squatarola*
  No hind toe .... *P. dominicus*
Faintly spotted above, under surface chestnut brown in summer. No hind toe .... *P. obscurus*

References.—Brisson, Orn., 5, 42, 1760 (*Pluvialis,* type *Charadrius apricarius* L.) Cuvier, Reg. Anim., 1, 467, 1817 (*Squatarola,* type *Tringa squatarola* L.) Bonaparte, Compt. Rend., 43, 417, 1856 (*Pluviorhynchus,* type *Charadrius obscurus* Gmel.)

Grey Plover

Pluvialis squatarola

No specimen of this species has so far been collected in New Zealand, but in February, 1946, R. B. Sibson, with other local observers, saw a Grey Plover associating with Knots near Miranda in the Firth of Thames. It was probably the same bird that was seen in the same locality in 1947 and 1949, both times in January.

Adult—Summer Plumage. Upper surface mottled with bars of black and ashy white, lower back and rump dusky brown mottled with white; upper tail coverts and tail white barred with black; quills black, inner webs white. A band of white extends from the forehead over the eye and down the side of the neck to the breast where it widens. Lores, sides of face and under surface black, except the abdomen and under tail coverts which are white; axillaries black. Bill and feet black. Bill 28-32, wing 180-200, tail 68-84, tarsus 42-50, mid toe 26-30 mm.

In winter the black on the face and under surface is absent; upper surface ashy brown, the feathers edged with whitish; throat and under surface white.

Eggs. Clutch four, ovate pyriform, pinkish to brownish, spotted all over but mostly at larger end with blackish brown to dusky drab. 51.7 x 35, 52.4 x 37, 54.6 x 37.8 mm. Taimyr Strait, Siberia.

Distribution. Miranda. One sight record. Breeding in polar regions of North America, Europe and Asia, and migrating in the northern winter as far south as Southern Brazil, South Africa and Australia. Straggler to Tasmania.

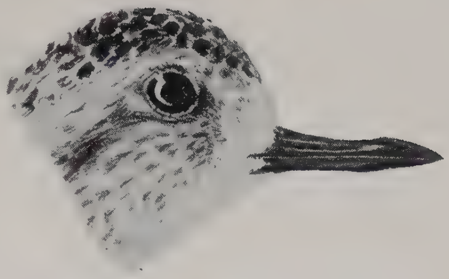
Nesting. On the tundra in the valley of the lower Petchora, Russia, Seebohm found the nests to be hollows, evidently scratched, on dry tussocky ridges intersecting the bog. Eggs were present in June and July. The Grey Plover is a shore loving bird, seldom going far inland.

References.—Linne, Syst. Nat., ed. X, 149, 1758 (*Tringa squatarola*, Sweden). Sibson, N.Z. Bird Notes, 3, 82, 1949.

Eastern Golden Plover

Pluvialis dominicus fulvus

In 1835 Yate recorded the Takahikahi from the Bay of Islands. His description fits the Golden Plover, but the nesting habits he gives was probably supplied by a Maori who either failed to comprehend what bird Yate was talking about or else invented a reply that he thought would please him. Some time about 1840 Miss Stone procured a specimen of the Golden Plover in New Zealand and sent it to the British Museum. There are no reliable records of the Golden Plover having been seen in the South Island before 1900 when one was shot at Lake Ellesmere. Bathgate's record of Maniototo Plains, 1862, and Hector's of Black Peak, 1862, could be accepted only if it were known that Golden Plovers visited the interior of Otago.



Margaret A. Morison

GOLDEN PLOVER

Adult—Summer Plumage. Top of head, back and scapulars black, spangled with golden buff; forehead and line over eye extending down side of neck to white patch on breast, white; upper wing coverts brown spangled with white; quills brown; tail brown barred and tipped with buff. Lores, spot in front of each eye, cheeks, middle of breast and abdomen black; white patch on sides of upper breast; sides of body variegated with black, white and golden buff; axillaries and under wing coverts greyish brown; under tail coverts white barred with black. Bill black. Iris dark brown. Feet leaden grey. Bill 21-25, wing 147-188, tail 58-69, tarsus 39-46, mid toe 22-27 mm. *Adult—Winter Plumage.* Differs from summer plumage in the absence of white on the forehead, over eye, neck and sides of breast; instead of black on the throat, sides of face, middle of breast and abdomen, the sides of face and throat are buff white streaked with brown, breast and sides of body buffy white spotted with brown, the abdomen whitish barred with brown, under tail coverts white. *Immature.* Similar to winter plumage but golden yellow spots on upper surface more conspicuous; chest strongly tinged with yellow. *Nestling.* Upper surface mottled with yellow and black, the yellow predominating on the crown, back and rump; hind neck, patch under eye and under surface white.

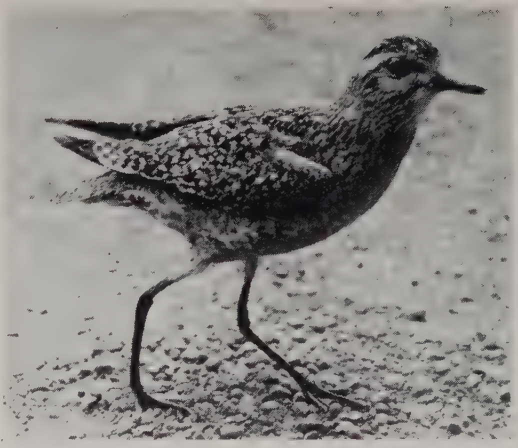
Eggs. Clutch four, pale buff, spotted and blotched with dark and light brown, 48 x 33, 47 x 33.6, 48.9 x 33.3 mm. Siberia.

Status. The American and Eastern Golden Plovers, which comprise the present species, are distinguished from the European Golden Plover by the axillaries and under wing coverts being brownish grey instead of white. Two subspecies are recognised, one, *P. d. dominicus,* breeding along the Arctic coast of North America and migrating as far south as the Argentine; the other, *P. d. fulvus,* breeding in eastern Siberia and Alaska and migrating to Australia, New Zealand and the Pacific Islands. This eastern subspecies differs from the American subspecies in its shorter wing and tail, longer bill and legs, and its more conspicuous yellow spots on the upper surface.

Distribution. A regular summer visitor to New Zealand, arriving in September and October and leaving in March and April. At Raoul Island in the Kermadecs, R. S. Bell informs me that the earliest date of arrival observed was September 9th, large flocks were seen in October, November and December, and the last seen was on March 31st. In New Zealand Golden Plovers appear to arrive first in the north and then move southward as far as Lake Ellesmere in Canterbury and the Bluff in Southland, though some are present in the north every month from September to April inclusive. Reported seen at the Auckland Islands.

The Eastern Golden Plover breeding in Siberia migrates to eastern Asia, the Malay Archipelago, Australia, Tasmania and New Zealand, while those which breed in Alaska travel to Hawaii and the eastern Pacific.

Habitat. The Golden Plover frequents the shores of harbours and estuaries and also of freshwater lakes near the coast. It is regularly seen at Parengarenga, Manukau, Firth of Thames, west coast of Wellington and Lake Ellesmere. It feeds on intertidal sand and mud mostly while the tide is ebbing. According to Sibson it goes a little way inland when the tide is full. The same observer states that there is a close association between Golden Plovers and Turnstones, both on the shore and in the resting places inland. The Turnstones usually outnumber the Golden Plovers.



C. J. Lindsay

GOLDEN PLOVER

Nesting. A proportion of the Golden Plovers that visit New Zealand are seen in partial or full breeding plumage each year mainly in March and April. In Siberia the Golden Plover breeds on the tundra where, says Seebohm, "Not a trace of a pine tree was visible and the birches rarely exceeded twelve inches in height. . . . The tundra was hilly with lakes, swamps and bogs in the wide valleys and plains." A somewhat similar account of the nesting of the Golden Plover is given by H. W. Brandt for the Askinuk Range, Alaska, at an altitude of 500 to 800 feet. "On this upper mountain slope," writes Brandt, "amid scattered rocky outcrops exists a grim Arctic flora of mosses and lichens. . . . On one of these velvet-like spots a little top moss is removed by the birds so as to make a slight depression in which the four beautiful eggs are placed. The lining of the nest is simply a few short unarranged stems of the reindeer moss. . . . The parti-coloured eggs and their environs blend as one in colouration, so, even in that jaeger-ridden land, they enjoy unusual protective security." The laying period extends from late May to the end of June, and both sexes incubate the eggs and care for the young.

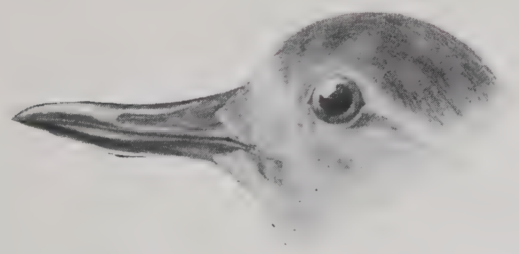
References.—Muller, Voll. Nat. Supply., 116, 1776 (*Charadrius dominicus,* San Domingo). Gmelin, Syst. Nat., 687, 1789 (*C. fulvus,* Tahiti). Buller, Birds N.Z., 212, 1872; 2nd ed. 2, 6, 1888. Bent. Bull. U.S. Nat. Mus., 146, 193, 1929. Sibson, N.Z. Bird Notes, 2, 6, 1946.

New Zealand Dotterel. Tuturiwhatu

Pluvialis obscurus

The naturalists of Cook's second voyage to New Zealand obtained specimens of this large dotterel at Dusky Sound in 1773. Forster stated that it was found on gravelly shores in the South Island. Latham based his description of the "Dusky Plover" on a specimen collected by Forster, and Gmelin translated Latham's name into Latin thus forming the specific name now in use. The species was next collected by Earl at Waikouaiti about 1840, and a specimen, the oldest now extant, forwarded to the British Museum. Colenso saw it on the shore of Manukau Harbour in 1842.

Adult—Summer Plumage. Upper surface brown, each feather margined with pale chestnut; band through forehead and narrow line over eyes white; wing coverts greyish brown edged with white; primaries dark brown; central tail feathers dark brown, outer ones much paler and with white tips. Chin white; under surface chestnut brown; under wing coverts, flanks, lower abdomen, and under tail coverts white. Bill black. Feet leaden grey. Bill 28-30, wing 150-165, tail 70-72, tarsus 36-42, mid toe 28-30 mm. The *adult in winter* has the upper surface brown without chestnut in the margins of the feathers; front, throat and under surface white, the breast crossed by an interrupted zone of dark grey or rufous. The *immature* is similar to the adult in winter, but there is a band of fulvous spotted with brown on the breast and there may be rufous on the sides. The *nestling* is buffy white above blotched and speckled with black, and is white on the forehead, sides of face and under surface.



Lily A. Daff

NEW ZEALAND DOTTEREL

Differences have been noted in coloration, for example, the amount of chestnut in winter and in juvenile birds and the brightness of the colour of adult birds, the explanation of which may be that there are definable differences between North Island and South Island forms.

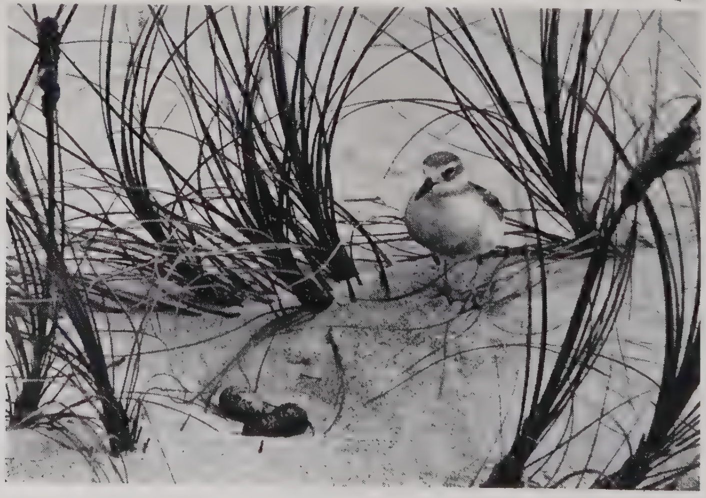
Eggs. Clutch three, ovoid, sharp pointed, stone colour with rather large blackish brown and pale brown blotches all over, with concentration in a zone near the larger end. 43.4 x 30.6, 44.4 x 31.5, 45 x 31.5 mm. Muriwai.

Status. The New Zealand Dotterel with its robust bill, equal in length to the middle toe and claw, and its somewhat spotted appearance seems better placed in *Pluvialis* than in *Charadrius.* It is perhaps a sedentary descendant of a former migratory species. There is a general resemblance in the winter plumages of the three species here included in *Pluvialis,* and in each there is a conspicuous change in summer in the colour of the under surface to black or chestnut.

Distribution. North Island, Great Barrier Island, South Island, Stewart Island. Formerly fairly plentiful throughout, now scarce except in the north of the North Island where it breeds as far south as Waikato Estuary, Firth of Thames and Tairua Bay, and in Stewart Island where there are a few birds breeding at Mason Bay. Recently recorded at Oreti, Southland (Sorensen), and at Te Araroa, Palliser Bay and Ohau.

Habits. This fine dotterel frequents the ocean beaches and also sand flats and mud flats in harbours and estuaries. It is also found inland on river beds and lake shores and, in the breeding season, often at high altitudes, on the mountains. It has, for instance, been observed at a height of 6,000 feet on Mount Egmont and between 7,000 and 8,000 feet in the Southern Alps. The birds that nest in such localities would, however, move to the coast in the non-breeding season, where they would come in contact with European settlement. Unfortunately, and unlike the Banded Dotterel, the New Zealand Dotterel has steadily retreated before our civilisation and consequently is no longer found in the mountain regions of the South Island. The food of this species consists of crustacea and small molluscs which it finds on the beaches between and above tide marks, and of insects which it seeks in other stations.

Nesting. The New Zealand Dotterel breeds in sandy places along the coast or it moves to higher ground perhaps far inland and to considerable elevations, as it formerly did in the South Island. Nests were found by Guthrie-Smith on the sand dunes at Mason Bay and also at the top of Table Hill at an elevation of over 2,000 feet, while Potts found a nest on Brownings Pass in the Southern Alps at a height of 4,800 feet above sea-level. The nest is a hollow in the sand or ground in which may be a few pieces of grass. Guthrie-Smith states that in nests in the sand the outline was blurred by the wind immediately the bird left the nest, and had frequently to be scraped out. The nesting season of this Dotterel has been carefully recorded by McKenzie in the Clevedon district. He found eggs as early as September 10th and ascertained the period of incubation to be 28-30 days. The young were flying about 50 days after hatching. At Muriwai Beach Fleming noted the first trace of chestnut in the birds on May 11th; many were in full breeding plumage in June; they were on the breeding grounds at the end of July; and eggs were hatching on January 4th. There is a February record for eggs so in the north laying takes place from mid-September to early January. In Stewart Island Guthrie-Smith found a chick on November 7th and two nests with eggs a few days later. It is likely, therefore, that laying dates in Stewart Island are about a month later than they are in the Auckland district. The young are able to run about



Pakiri *G. A. Buddle*

NEW ZEALAND DOTTEREL

very shortly after they are hatched. "To a greater extent, perhaps, than other shore birds," writes Falla of the New Zealand Dotterel in the North Auckland district, "they go through the curious performance which has been described as 'feigning injury.' It consists of a ruffling of the plumage, a limp drooping of the wings, and a helpless fluttering movement accompanied by cries of distress." The object of this is to divert attention from the nest.

References.—Gmelin, Syst. Nat., 686, 1789 (*Charadrius obscurus,* Dusky Sound). Potts, Trans. N.Z. Inst., 2, 68, 1870; N.Z. Jour. Sci., 2, 506, 1885. Buller, Birds N.Z., 208, 1872; 2nd ed., 2, 1, col. pl. 1888. Gray Zool. Erebus and Terror Birds, 11, col. pl., 1845. Guthrie-Smith, Mutton Birds, 102 1914. McKenzie, Notornis, 4, 24, 1950; 5, 15, 1952. Buddle, Bird Secrets, 40, 1951.

Genus Charadrius

Bill shorter than middle toe and claw. Tail rounded. Legs weak; tarsi much longer than bill; reticulated in front and behind. Small web between outer and middle toe. No hind toe.

In this genus are included a number of small plovers recognised by their short bills, uniform grey upper surface and white under surface. A black band from gape to eye is often present. The genus is cosmopolitan and includes about twenty species.

Synopsis of New Zealand Species,
Summer Plumage

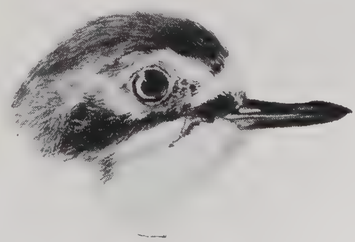
Two bands on breast, one black, one chestnut	*C. bicinctus*
One chestnut band on breast	*C. leschenaulti*
No coloured bands	*C. alexandrinus*
Breast chestnut with black lower edge	*C. asiaticus*

References.—Linne, Syst. Nat., 10th ed., 150, 1758 (*Charadrius,* type *C. hiaticula,* L.) Brandt, Voy. Sci. Altai Orient., 444, 1845 (*Eupoda,* type *Ch. asiaticus* Pall.)

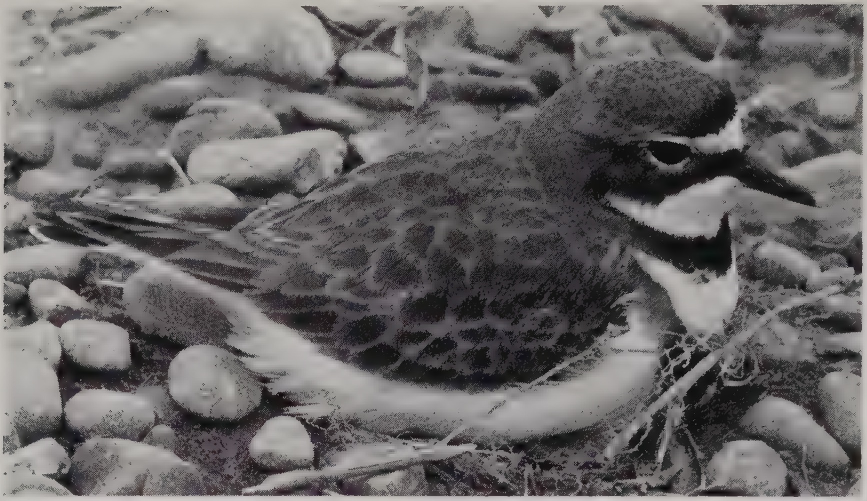
Banded Dotterel. Tuturiwhatu
Charadrius bicinctus bicinctus

Though more common in New Zealand this species was first discovered in New South Wales, whence specimens were described in 1827. It does not appear in New Zealand ornithological literature until 1845 when Gray included it in his account published in the report of the voyage of the *Erebus* and *Terror.* At the Chatham Islands, where it is common, Travers collected specimens in 1871.

Adult. Forehead white, margined above and below with black; upper surface greyish brown, the feathers with narrow pale margins; quills brown with white shafts; middle tail feathers brown, outer ones paler with white edges. A black band from the bill to the eye, and continued as an edging to the brown of the upper surface. Under surface white; a band of black across the breast, and a short space below it a broader band of chestnut. Bill black. Iris dark brown. Feet yellowish grey. Bill 16-18, wing 122-130, tail 55-60, tarsus 30-32, mid toe 21-25 mm. The *female* has a less showy plumage than the male, with the chestnut band not so deep in colour nor so wide. In the non-breeding season the black bands on the head and breast and the chestnut band on the lower breast are much reduced in colour and interrupted. *Immature.* Differs from the adult in the feathers of the upper surface being margined with rufous; forehead and under surface tinged with rufous; upper breast with a narrow band of dark mottled grey; no black on the head, nor chestnut band on the breast. The grey band gradually changes to black and a second band appears on the lower breast, at first chestnut mixed with white. *Nestling.* Upper surface buffy white thickly speckled with black, the wings and upper back with a reddish tinge, the wings edged with white. Under surface creamy white, sometimes red-



Margaret A. Morison
BANDED DOTTEREL



Ashley River *K. V. Bigwood*

BANDED DOTTEREL

dish buff on the breast. Both the ground colour and the size of the spots vary. According to Fitzgerald the yellowish chicks assume juvenile plumage with greyish belly and faint band indications, while greyish chicks, that is, with white background, develop pure white bellies and breasts.

Eggs. Clutch two or three, ovoid, dark greenish yellow, marked closely all over with irregular deep brown spots and blotches, 35.5 x 25, 35 x 25 mm. Waipara. Pale green, with close black spots and marks. 33 x 24.6, 33.5 x 24.4, 34 x 25 mm. Gollans Valley.

Status. The Banded Dotterel is a well defined species. On the main islands it does not vary sufficiently to indicate more than one subspecies, but birds from the Auckland and Campbell Islands are definitely larger and so constitute another subspecies.

Distribution. Accidental at Raoul Island, one occurrence, September, 1913, male. Breeding in North, Great Barrier, Kapiti, South and Chatham Islands. Stewart Island, not known to breed.

Southern Australia from South-west Australia to South Queensland. Tasmania. Most abundant from South Australia to New South Wales and northern Tasmania. Not known to breed in Australia or Tasmania. Visitor to Lord Howe and Norfolk Islands, February to October. One record from New Hebrides Islands.

Migration. The seasonal movements of this species in New Zealand consist of a regular and large movement northwards at the end of the breeding season and a return in early spring. There are also local migrations from the coast to inland breeding areas and back to the coast. All birds do not take part in the general migratory movement but apparently all birds in inland stations depart for the coast for the non-breeding season. Inland birds gather together and move to the coast in February probably mostly to join the northward migration. In March large numbers of Banded Dotterel are present from Manukau Harbour to the Bay of Plenty. Large flocks may be seen during the winter in Parengarenga Harbour. The southward movement takes place in June, July and August, when laying begins. The birds breeding on the Wairarapa Plains, according to Stidolph, are present there from July to February but Banded Dotterel are found on the coast in Palliser Bay all the year round. Marples has recorded Banded Dotterel wintering on the coast of Otago.

The question as to the migration of the Banded Dotterel between Australia and New Zealand is thus summed up by Serventy and Whittell: "It seems quite certain that all the Australian birds are migrants from New Zealand. A quota of non-breeding birds remain in Australia during the normal nesting season." Most of the birds seen in Australia are in winter plumage, but some in full breeding plumage have been observed in September. March to August is the usual time that the Banded Dotterel is found in Australia and Tasmania. A bird in breeding plumage was seen in Victoria at the end of December (B. Amos). Stead maintained that the route followed on migration was from north New Zealand to south Queensland and New South Wales via Norfolk and Lord Howe Islands. The occurrences in these ocean islands appears to support this view though it is unlikely that all Banded Dotterel crossing the Tasman Sea travel by the same route.

Ecology. Open ground along the sea coast and inland, especially river beds and lake shores, is the natural haunt of the Banded Dotterel. It has taken kindly to settled districts where it frequents tilled ground and fields in which the grass is not long. Thus the advance of settlement has widened the habitat of this species. It is found at fairly high altitudes in mountainous districts. On Mount Tongariro, in summer, it has been observed at a height of 4500 feet above sea level. The colour of the Banded Dotterel admirably harmonises with its surroundings. Its grey back asssimilates to sand or shingle, while the white breast and dark bands resemble stones and their shadows.

Food. The food of the Banded Dotterel consists almost entirely of insects and crustacea. According to Stead this species feeds on the succulent fruits of *Coprosma petriei* and *Muehlenbeckia axillaris* growing on river flats in inland Canterbury. As it frequents settled districts, especially selecting ploughed land, it must be considered an entirely useful bird.

Nesting. Banded Dotterel arrive at the breeding grounds mostly in July. Some have come from a long distance, may be from Parengarenga Harbour in the far north, others may have come only from the coast. Full breeding plumage is assumed by the time of arrival or before. In Canterbury, according to Stead, the dotterel begin to lose their breeding plumage in December and assume it again in May. In the North Island the moults apparently occur a little later. Thus Fitzgerald says that the bands fade in February and the breeding plumage is again assumed during May to July.

For nesting the Banded Dotterel prefers sandy or shingly areas from the beaches along the sea coast to river beds and other open spaces as far inland as the centre of the islands. It has been noted breeding, for example, near Lakes Rotorua and Tarawera in the North Island and near Cromwell in Central Otago. It also breeds on open fields or tilled ground in the settled districts.

The nest is merely a hollow in the shingle or sand with or without a little drift material. The eggs are laid from August to November and the chicks are able to run soon after they are hatched. The period of

G. A. Buddle

BANDED DOTTEREL

incubation was determined by Fitzgerald to be not less than 28 days. When their breeding place is approached the bird leaves the nest and endeavours to entice the intruder away. Occasionally it feigns injury and sometimes even death, but more often it pretends to be searching for food, always edging away from its nest. When it considers the suspected marauders are at a safe distance the bird rises in the air and wheels round to the vicinity of the nest. If the young are about, a note from the parent causes them to lie quite still, and another informs them that the danger has passed. Banded Dotterel become quite tame if approached quietly, allowing themselves to be photographed on the nest from a distance of a few feet.

The following interesting information describing the first year's life of the chick is recorded by M. E. Fitzgerald of Tirau: From hatching, in nineteen days feathering is well shown, in seven months juvenal's bands appear and are complete in males by eight months; in females by three weeks to a month later. Preparing to mate in nine months. Lose colour in twelve months and are in full eclipse plumage again thirteen months from hatching.

References.—Jardine and Selby, Ill, Orn., 1, 228, 1827 (*Charadrius bicinctus*, New South Wales). Buller, Birds N.Z., 210, 1872; 2nd ed., 2, 3, col. pl. 1888. Stead, Life Hist. N.Z. Birds, 81, 1932. Fitzgerald, Ann. Rep. Orn. Soc. N.Z., 1941. Stidolph, Emu, 44, 85, 1944. Buddle, Bird Secrets, 44, 1951. Wilkinson, Kapiti Bird Sanct., 100, 1952.

Auckland Islands Banded Dotterel

Charadrius bicinctus subsp.

A "Ring Plover" was seen at the Auckland Islands by Dr. M'Cormick, surgeon on the *Terror,* one of the ships of the British Antarctic Expedition, in 1839. In 1889 Reischek saw a Banded Dotterel at the Auckland Islands, but specimens were not collected until 1944 when they were brought back by ornithologists attached to the military watching party.

Immature. A male, nearly mature, bird from Adams Island is similar in coloration to the New Zealand mainland form, the frontal black bands being well developed. Signs of immaturity are the bands on the under surface not being fully developed. There are grey feathers in the black band and white feathers in the chestnut band. The back is brown but of a darker shade than in the typical subspecies and the wing coverts and feathers of the lower back are edged with pale rufous. There is some brown on the lower thighs. Bill 18, wing 132, tail 65, tarsus 33, mid toe 29 mm.

This subspecies is characterized by its larger size, stouter bill and feet, and by its darker upper surface.

Distribution. Auckland Islands. Campbell Island.

Large Sand Dotterel

Charadrius leschenaulti

No specimens of the Large Sand Dotterel have so far been taken in New Zealand, but the species has been seen at close quarters in several localities in Manukau Harbour and the Firth of Thames. The first example seen was associating with Wrybill Plovers and was detected by P. C. Bull at Puketutu on Manukau Harbour on August 20th, 1943. It was next seen by Bull and Sibson in the same locality on September 5th.

Adult—Summer Plumage. Upper surface light brown, tinged with rufous on upper back and scapulars, the wing coverts margined with white; tail brown with white tip, outermost feathers white; on the forepart of the crown is a band of cinnamon rufous extending down the side of the neck and across the hind neck; a white band from the forehead extends over the eye; lores and spot below eye black; sides of face and under surface white with a narrow band of rufous across the chest. Bill black. Iris brown. Feet olive grey. Bill 22.5-26, wing 132-144, tail 51, tarsus 34-38.5 mm. The adult *female* is similar but the colours are less pronounced and the black on the head is absent. In *winter* the rufous facial and chest markings are absent, and there is no black on the head.

Distribution. Seen on several occasions at Puketutu, Puhinui and Karaka on Manukau Harbour, and at Miranda on the Firth of Thames.

Breeds from Turkestan and Persia eastward to Korea and China. Migrates in the northern winter to South Africa, India, Malay Archipelago, New Guinea, and Australia. Accidental in Lord Howe Island.

Habits. The Large Sand Dotterel is a summer visitor mainly to Northern and Western Australia, being more common in the northern part of the continent. It frequents sandy and shingly beaches and mud banks along the shore and in tidal creeks. In Formosa its nest consists only of a slight depression in the sand.

References.—Lesson, Dict. Sci. Nat., 42, 36, 1826 (*Charadrius Leschenaultii,* India). Sibson and Bull, Emu, 45, 223, 1946. Sibson, N.Z. Bird Notes, 3, 51 1948; Notornis 5, 179, 1953.

Red-capped Dotterel

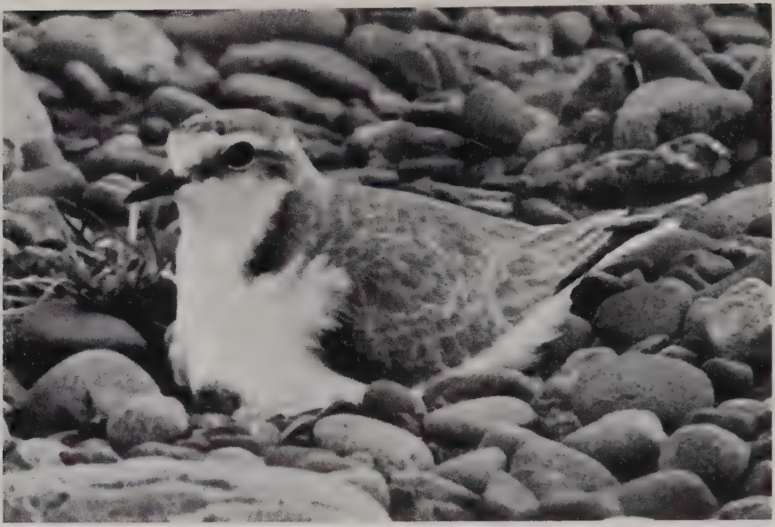
Charadrius alexandrinus ruficapillus

The Red-capped Dotterel, a common Australian species, is known to have occurred in New Zealand twice. The first record is based on a specimen obtained on the beach near Waikanae in December, 1878. The second occurrence makes a rather amazing story, not yet completed. In August, 1947, Mr. L. A. Shand discovered a female bird on the shingly bed of the Ashley River, Canterbury Plains, sitting on two eggs. A flood washed these away, but a few weeks later the bird was again found sitting on a second couple of eggs. These were later collected and one was found to be infertile and the other partly incubated but dead. This Red-capped Dotterel had paired with a male Banded Dotterel which, says Shand, took his turn at incubating the eggs. Three years later the pair, possibly the male bird was a different one, hatched two chicks, one of which was seen by Mr. Shand when it was a year old. This interspecific hybrid is described below.

Adult—Summer plumage. Top of head, hind neck and upper mantle rusty red; front white, extending as a narrower band above the eye and bordered above by a narrow strip of black; a black band from bill through eye to side of neck ending in a patch of black and rufous on the side of the breast. Remainder of upper surface light brown, the feathers margined with rufous, lateral upper tail coverts white; marginal wing coverts dark brown; greater coverts tipped with white forming a narrow wing band; primaries dark brown, outermost pair blackish on their outer webs and tips, the inner pair margined with white; outer secondaries white, brownish near the shaft. Four central tail feathers dark brown, outer ones white. Sides of face and under surface white. Bill black. Iris dark brown. Feet blackish brown. Bill 15, wing 105, tail 43, tarsus 28, mid toe 19 mm. The *male* in winter, *female* at all seasons and the *immature* have brown instead of black on the head and the rusty areas are paler. *Nestling:* Upper surface pale yellowish buff spotted with black, under surface white.

Hybrid. The hybrid between the Red-capped Dotterel and the Banded Dotterel bred on the Ashley River bed is described in the following words by Mr. Shand in a letter written to me on 28th November, 1951. "It was very like its mother, being a little smaller than the Banded Dotterel and lighter on the back; very white on the under part with a narrow, not more than half an inch wide, chocolate band across the chest with no sign of a black band whatsoever, also no sign of a yellow or orange stripe up each side of the neck as the mother bird has." This case of hybridism is certainly the most interesting that has been reported among New Zealand indigenous birds. The characters of the hybrid are clearly derived from parents belonging to two different species.

Eggs. Clutch two, pyriform, stone colour, thickly marked all over with small and moderate sized irregular black blotches, lines and spots. 30 x 23, 31 x 23 mm. Ashley River. These eggs from a mixed pair are



Ashley River *K. V. Bigwood*

RED-CAPPED DOTTEREL

larger than true red-capped dotterel's eggs from Australia, for example, 27 x 20.5 mm.

Status. The Red-capped Dotterel of Australia and Tasmania is now classed as a subspecies, *ruficapillus,* of the widely distributed species *Charadrius alexandrinus,* the typical subspecies of which is the Kentish Plover of Europe. The Kentish plover is described as having a white collar round the neck. There is no white collar in the Australian subspecies.

Distribution. New Zealand. Two occurrences. Waikanae. Ashley River. Australia. Tasmania. The species is cosmopolitan and has been divided into about twelve subspecies.

Habits. The Red-capped Dotterel inhabits the sandy and shingly beaches and the intertidal flats along the coasts of Australia and Tasmania, and also swamps near the coast and salt lakes inland. Its food consists of small animals such as insects, crustacea and mollusca. The nest is a slight depression in the sand a little distance above high water mark, and is usually lined with pieces of seaweed or other material found nearby. The young leave the nest about two hours after hatching. The parents, during incubation and while the chicks are young, feign injury in order to attract intruders away from their nest or from their young which lie perfectly still when warning cries are given by the parents. They rely for protection on the harmony of their colour with the surroundings.

References.—Temminck and Laughier, Pl. Col. Ois., pl. 47, 1821 (*C. ruficapillus,* New South Wales). Buller, Birds N.Z., 2nd ed., 2, 5, 1888. Kirk Trans. N.Z. Inst, 12, 246, 1880. Falla, N.Z. Bird Notes, 2, 194, 1948.

Oriental Dotterel

Charadrius asiaticus veredus

The only specimen of this eastern Asiatic species that has been taken within the New Zealand region is the one I shot on Denham Bay beach, Raoul Island, on April 22nd, 1908.

Adult—Summer Plumage. Forehead buffy white; top of head and hind neck brown washed with rufous; eyebrow and sides of face buffy white. Upper surface brown with slight rufous edges to the feathers; primary coverts and quills and secondaries dark brown; tail brown with a white tip, the outer feathers white on their outer webs. Throat white; foreneck and chest chestnut extending down the sides of the upper breast and followed by a horse-shoe mark of black; remainder of under surface white; under wing coverts and axillaries smoky brown. Bill black, horn colour at base of lower mandible. Iris dark brown. Feet flesh colour, joints brown. Bill 25, wing 165, tail 62, tarsus 45 mm. *Adult—Winter Plumage.* Differs from the summer plumage in the chestnut and black of the foreneck, chest and sides of breast being replaced by pale brown. *Immature.* Similar to the adult winter plumage.

Distribution. Kermadec Islands. One occurrence, Raoul Island.

Siberia, Mongolia and northern China; breeding. Migrating in northern winter to Japan, Malay Archipelago, New Guinea and North-western Australia where it arrives in September and leaves in March.

Habits. The Oriental Dotterel visits North-western Australia in large numbers during the southern summer. It frequents the salt marshes and spinifex flats near the coast and feeds on insects.

References.—Gould, Proc. Zool. Soc., 1848, p. 38 (*C. veredus,* N.W. Australia). Harting, Ibis, 1870. p. 209 col. pl.

Black-fronted Dotterel

Charadrius melanops

A Black-fronted Dotterel was observed by Mr. D. Brathwaite at close quarters at Ahuriri Lagoon, near Napier, on August 29th, 1954.

Adult. Forehead black, crown brown. A white band in front of and passing over the eye and round the back of the neck. A black line from gape to eye and a black band extending backwards from the eye and dividing into a band round the back of the neck and another across the breast. Back, upper tail coverts and middle of wing brown; shoulders deep chestnut; greater wing coverts tipped with white; primaries black. Two middle tail feathers brown tipped with black; next three on each side blackish brown with white base and tip; remainder white. Under surface, except chest band, white. Bill orange tipped with black. Iris brown with bright red orbital ring. Feet flesh colour. Bill 15, wing 106, tail 56, tarsus 25 mm.

Eggs. Clutch three-four, pyriform, light stone closely marked all over with fine spots and lines of umber and dark grey. 28-29 x 20-22 mm.

Distribution. Ahuriri Lagoon. One occurrence (sight record). Australia, breeding. Accidental in Tasmania.

Habits. In Australia the Black-fronted Dotterel frequents the edges of lakes, rivers and lagoons, inland or near the sea. The eggs are laid in a slight hollow on river beds or on sandy ridges near water. The food includes insects, worms and small crustacea.

Reference.—Vieillot, Nouv. Dict. Hist. Nat., 27, 139; 1818 (*Charadrius melanops,* New South Wales). Brathwaite, Notornis, 6, 146, 1955.

GENUS THINORNIS

Bill slender, longer than middle toe and claw, dertrum small and short; nasal and interramal grooves long. Tail graduated. Tarsus shorter than culmen; reticulated. No hind toe.

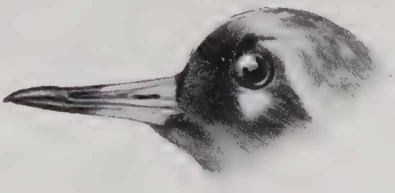
A distinct genus distinguished by the long pointed bill which is longer than the tarsus, and the graduated tail. A single species confined to the New Zealand region.

Reference.—Gray, Zool., Erebus and Terror, Birds, 11, 1845 (*Thinornis,* type *Charadrius novaeseelandiae,* Gmel.).

Shore Plover. Tuturuatu

Thinornis novaeseelandiae

Forster, during Cook's second voyage, met with this endemic species both at Dusky and Queen Charlotte Sounds. In the former locality it was observed at the mouths of rivers and in gravelly places on the sea coast.

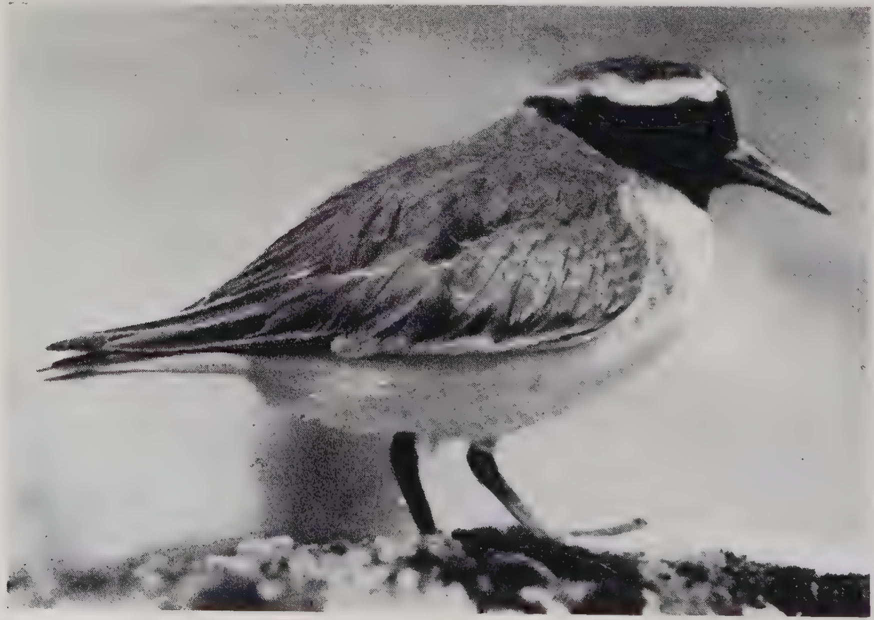


Lily A. Daff

SHORE PLOVER

As with many of Forster's discoveries, Latham gave a vernacular name which Gmelin Latinised long before Forster's own account was published (1844). The species was observed in Wellington Harbour in 1840, was collected by Earl on the Taieri coast in 1844 and was discovered at the Chatham Islands by Travers in 1871. The Sand Plover was formerly moderately plentiful in many parts of the North, South and Chatham Islands. It soon succumbed to the conditions of settlement on the main islands, where it seems to have disappeared completely by about 1880. Potts saw three in Otago about 1872. In 1888 Buller said that they had been discovered to be fairly plentiful on various parts of the coast but this statement need not have referred to any time after 1872.

Adult. Forehead, sides of head, throat, fore part of neck and rather narrow nuchal collar brownish black; crown and hind part of head greyish brown, separated from the black plumage, except on the hindneck, by a band of white passing over the eye and diagonally across the top of the head. Remainder of upper surface greyish brown; wing coverts with terminal whitish band; primaries dark brown with a central white streak; secondaries white on their inner webs the innermost pure white; central tail feathers dark brown, outer ones white on their outer webs, and the outermost pure white. Under surface below the foreneck white. Bill orange with a black tip. Iris dark brown, eyelid orange. Feet pale orange, claws black. Bill 23-25, wing 113-128, tail 55-65, tarsus 22-24, mid toe 19-24 mm. The *female* is similar but the cheeks and neck are brownish. Blackish tip to bill more extensive than in male. The *immature* has the upper surface brown with a tawny tinge; wing coverts, scapulars and feathers of the mantle tipped with light fawn; forehead light brown, the feathers edged with white. White line over eye fairly well developed; cheeks below white eye band brown becoming brownish white on the throat; a light brown neckband reaches as far down the chest as does the black coloration of the adult. Bill blackish, lighter



South East Island *E. G. Turbott*

SHORE PLOVER

at base of both mandibles. The *nestling* has the upper surface, sides of head and wings mottled in grey, buff, tawny yellow, dark brown and blackish spots; under surface tawny white. Bill blackish, slightly flesh colour at base. Feet flesh coloured. The above descriptions are based on Chatham Island birds and in the main from Fleming's account. *Colour variety.* A pure white example was collected at the Chatham Islands about 1880 by Mr. Palmer and was sent to the Tring Museum.

Eggs. Clutch three, ovoid, pale stone colour, olive-buff or pale brown with small dark brown blotches, spots and linear markings all over, but more abundant at the larger end. 34 x 25, 36 x 24.5, 38.5 x 26.5 mm. Chatham Islands. (Fleming's measurements).

Distribution. North and South Islands; formerly plentiful on many parts of the coast; early locality records are: Great Barrier Island, Whangapoua, Lake Rotorua, Piako River, Manukau Harbour, Tauranga, Wellington (1840), Taieri, Cargill River, Okarito. Now gone from the main islands. Formerly throughout the Chatham group but now breeding only on South East Island where Fleming estimated there were, in 1937, about 70 pairs. The Auckland Island record of *T. rossii* is probably an error. Hutton stated that the Sand Plover bred in the South Island and passed the winter in the North Island.

Habitat. On the mainland Potts stated that the Shore Plover inhabited sandy beaches especially near the mouths of rivers. On South East Island in the Chatham group there are no sandy beaches and Fleming found the birds frequenting the turf-like halophytic vegetation and the luxuriant herbaceous growth in the bays between the rocky headlands, and to some extent on the top of the island. The birds feed in the salt and brackish pools which abound with small crustacea which Fleming thinks probably form their main food.

Nesting. The following information is taken from Fleming's account of the breeding habits of the Shore Plover on South East Island. "Nest sites are remarkable for their diversity in all but one feature. With one exception all the seventeen nests examined were in some way sheltered from above and entered from the sides. The one exception was on a boulder beach sheltered by three large boulders but open to the sky. All other nests were in some horizontal tunnel sheltered from above. The most frequent nest sites were crevices under piles of boulders near the shoreline and crannies under larger rock masses resting on grassy ground above the beach. Several nests were found eighteen inches down deserted burrows of mutton birds, while other sites included a hollow log in the open with two entrances, one at each end; the space under a lying log; a small tunnel in thick bidibidi (*Acaena*) and the space under the buttress roots of a shrub.

"The nest is comparatively complicated for a wading bird—a circlet of interwoven dried roots and grass, forming quite a bulky structure if the subjacent soil is perpetually moist, but more scanty on well drained terrain, such as the upper portions of boulder beaches where coarse grit frequently formed the floor of the nest. We found about equal numbers of clutches of two and of three eggs. Eggs were laid daily as far as could be gathered. Once incubation of the full clutch began one of the parents, usually the female, was always on the nest. At times of extreme excitement odd birds would perform the 'broken wing' reaction, not only the birds whose nest was immediately threatened by our presence, but occasionally other visiting birds whose nest was some distance away. When first hatched downy chicks are helpless, but only for a few hours."

Mr. E. W. Dawson informs me that a nest containing three eggs was found on February 3rd, 1954, on South East Island in a rock crevice above high water mark.

References.—Gmelin, Syst. Nat., 684. 1789 (*Charadrius novaeseelandiae*, Queen Charlotte Sound). Gray, Zool., Erebus and Terror, Birds, 12, 1845 (*T. novaeseelandiae T. rossii*, col. pl.).

Potts, Trans. N.Z. Inst., 6, 150, 1874; N.Z. Jour. Sci. 2, 508, 1885. Buller, Birds N.Z., 214, col. pl., 1872; 2nd ed., 2, 11, col. pl., 1888. Fleming, Emu, 39, 1, col. pl., 1939.

GENUS ANARHYNCHUS

Bill slender, sharp-pointed, deflected to the right, longer than middle toe and claw. Tarsi reticulated; toes webbed at the base and narrowly margined. No hind toe.

This genus is unique in having the bill deflected to one side. The angle of deflection is about twelve degrees and is evident in the chick on hatching. According to Stead, the embryo in the egg has the bend well developed. *Anarhynchus* comprises a single species confined to New Zealand.

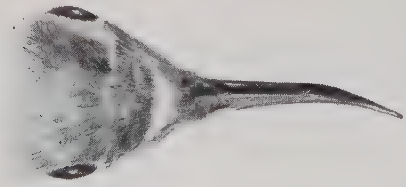
Reference.—Quoy and Gaimard, Voy. Astrol. Zool., 1, 252, 1830 (*Anarhynchus,* type *A. frontalis,* Q. and G.).

Wrybill Plover. Ngutu-parore

Anarhynchus frontalis

Quoy and Gaimard, the zoologists of the French exploring ship *Astrolabe,* which visited New Zealand in 1827, discovered this remarkable species in Hauraki Gulf. It was found in small flocks on mud flats in the gulf and was described and figured in the report on the zoology of the voyage. Little more was heard of the species until forty years afterwards when Potts investigated its breeding and feeding habits.

Adult—Breeding Plumage. Upper surface uniform bluish grey, the blue tint weakening with age; wing coverts edged with white; quills brown, darker on the outer web and tips; central tail feathers greyish brown, outer ones pale grey margined with white. A band of white across the forehead and extending as a narrower band above the eyes; a narrow brown line above the white on the forehead; lores, band under eye, and ear coverts grey; across the chest a broad black band, the feathers edged with white; remainder of under surface white. Bill black. Iris dark brown. Feet blackish green. Bill 28-30, wing 114-120, tail 46-50, tarsus 27-30, mid toe 24-27 mm. In the *non-breeding* season, February to end of April, the pectoral bands are absent. During May, June and July they may be seen in various stages of development. In the *female* the pectoral band is narrower and paler. *Immature* similar to the adult but paler and without the pectoral band which is gained at the time the adults are assuming their breeding plumage. *Nestling* pale grey speckled with black above, white below.



Lily A. Daff

WRYBILL PLOVER

Eggs. Clutch two, very rarely three, pyriform, pale grey faintly tinged with blue or green, closely and evenly covered all over with minute dark and pale blotches, spots and lines. 32.5 x 25.8, 33.8 x 25.2, 35 x 26.5 mm.

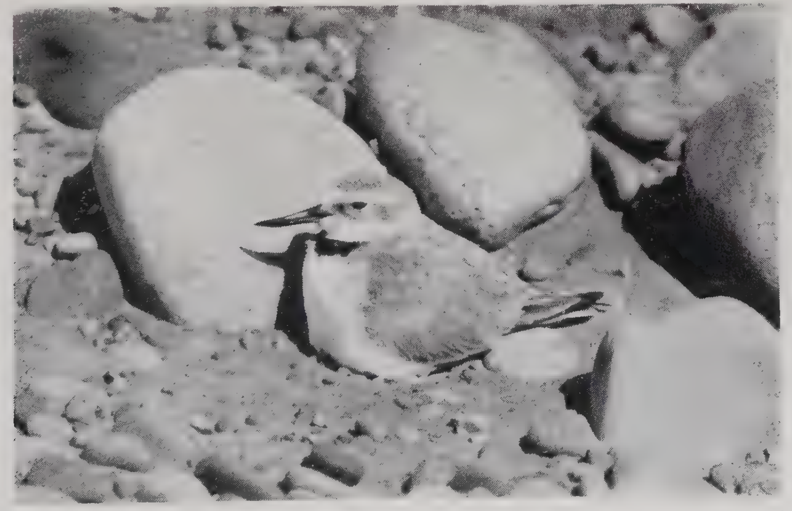
Distribution. North and South Islands; moderately plentiful in its breeding and its wintering areas, rare or absent elsewhere. Breeds on the shingly beds of the Waiau, Hurunui, Ashley, Waimakiriri, Rakaia and Rangitata Rivers in Canterbury. The northward migratory movement extends from December to May; the southward movement from July to September. The following information is taken from a paper by Sibson who, with other ornithologists, has kept a watch on the wrybills wintering in Manukau Harbour and the Firth of Thames. The first migrants usually appear in February. The maximum population is reached about the end of May. As many as 700 birds have been seen at one time in the Firth of Thames. The winter habitat of the majority of Wrybills is the Firth of Thames or the harbours of Kaipara and Manukau. The bulk of the Wrybill population is to be found in these three places between roughly the end of April and the beginning of August. Small flocks go as far north as Parengarenga

Harbour. Some Wrybills are present in the North Island every month of the year. Evidently immature non-breeders do not travel to the South Island with the breeding birds.

Habitat. In the breeding season, lasting less than half of the year, the Wrybill lives inland on shingly river beds, preferring those with wide areas not covered with vegetation. The remainder of the year it spends its time on mud and sand flats in harbours and estuaries and, in lesser numbers, on sea beaches. Sibson writes: "Certain features in the behaviour of the Wrybills in their winter quarters stand out. With remarkable regularity, day after day, they gather at the same resting place as the incoming tide moves over the flats. Both in Manukau Harbour and the Firth of Thames—there is probably a similar place, if not more than one, in Kaipara Harbour too—this is a bank of clean shingle which only unusually high spring tides cover. At their high tide roosts Wrybills keep to themselves and do not willingly associate with other species."

In its pattern of coloration, as in that of its chicks and eggs, the Wrybill harmonizes exactly with the stones among which it lives. The upper surface of the adult bird assimilates to a stone while the breast with its dark band resembles a whitish stone and its shadow. The resemblance of the chicks and eggs to gravel is complete. The unique feature of the bill being bent to the right has been the source of discussions on its advantages to the wrybill since Potts, in 1871, wrote: "As the flexure of the bill is lateral, the bird is enabled to follow up retreating insects by making the circuit of a waterworn stone with far greater ease than if it had been furnished with the straight beak of the plover, or the long flexible scoop of the avocet." But E. F. Stead, who watched these birds at close quarters, thought that the advantage which Wrybills would have on account of their deflected bill was very slight.

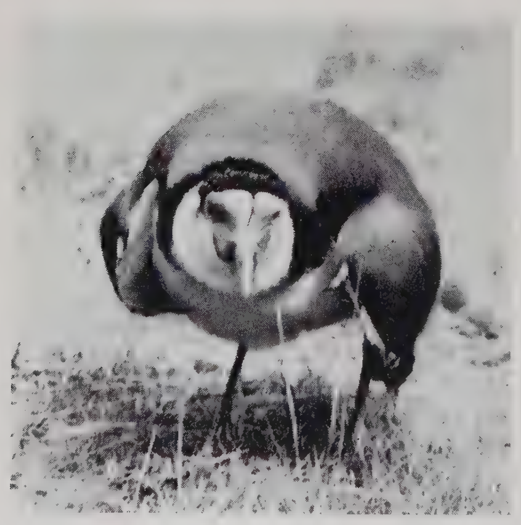
Nesting. According to Stead the Wrybill returns to Canterbury to breed during August. It is then in full breeding plumage. The two desiderata of the Wrybill for its nesting site are considerable areas of bare shingle and the proximity of water. "Wrybills," says Stead, "nest on high shingle spits, choosing a place where the stones are rather large, and clear of all growths and drift. A mere scratching in the sand, occasionally with a few small pebbles added around its edges, serves as a receptacle for the two



E. F. Stead

WRYBILL PLOVER

eggs, which are wonderfully like the stones among which they are laid. Laying commences about the middle of September and continues throughout October. Eggs have been found in November but they probably were second clutches. Both birds take their turn at incubation, and sit very close. The first young birds appear in the last week of September. The young leave the nest within a day of hatching, and follow their parents about in search of food. They take to the water readily, and swim well when only a day or two old. By the time the young are full grown, the old birds are moulting into their winter plumage, when they closely resemble the young—having no black chest band, and no frontal bands—and then old and young leave the river beds. The earliest families have left by the end of December, and all of them have gone by the end of February." "The parent birds," writes Potts, "never appear to separate far from each other during the period of incubation; on being disturbed they exhibit a peculiar habit of partially extending the wings, the effect of which is that they assume a broad and flattened appearance across the back, the head at the time being carried very low, the bill just clearing the ground, whilst a low purring sound is emitted."


Gretna, Tasmania *J. M. Cunningham*
SPUR-WINGED PLOVER

References.—Quoy and Gaimard, Voy. Astrol. Zool., 1, 252, 1830 (*Anarhynchus frontalis,* Hauraki Gulf). Potts, Trans. N.Z. Inst., 3, 93, 1871; N.Z. Jour. Sci., 2, 50, 1885. Buller, Birds N.Z., 216, 1872; 2nd ed., 2, 9 col. pl., 1888. Stead. Life Hist. N.Z. Birds, 91, 1932. Oliver, Emu, 37, 1, col. pl. (not good), 1937. Sibson, Emu, 43, 49, 1943. Urquhart and Sibson, Notornis, 4, 170, 1952.

Genus Lobibyx

Bill with a short dertrum, nasal grove wide and long. A fleshy wattle in front of the eye with a large upper lobe and a pendant lappet. Wing with a well developed spur near the carpal flexure. Tarsi scutellate in front, reticulate behind. Small web between outer and middle toe. A small hind toe present.

The presence of wattle, spur and hind toe are the distinctive features of this genus.

New Guinea, Australia and Tasmania.

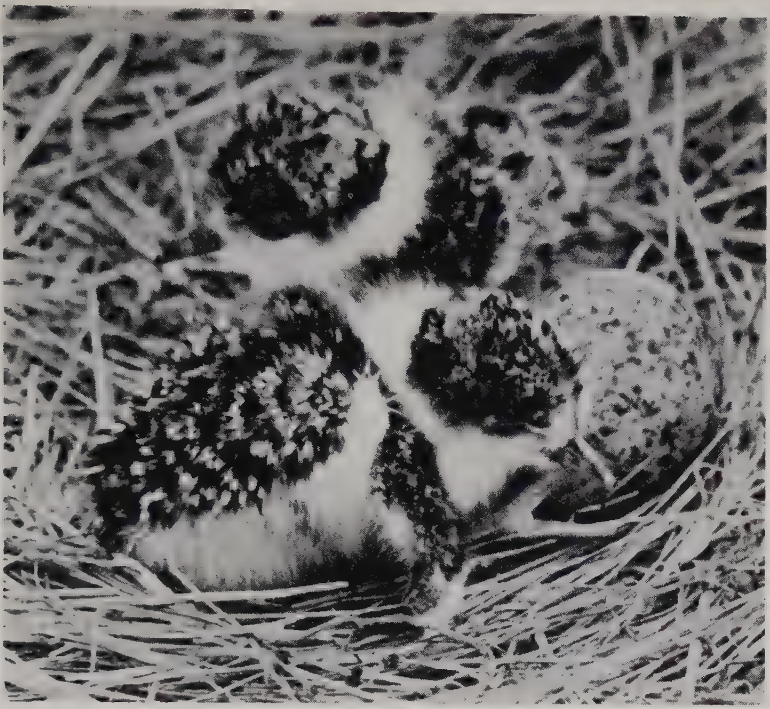
References.—Heine and Reichenow, Nomen. Mus. Hein., 334, 1890 (*Lobibyx,* type *Vanellus novaehollandiae,* Steph.).

Spur-winged Plover

Lobibyx novaehollandiae

The Spur-winged Plover is an Australian species that has successfully established itself in New Zealand. Stragglers were recorded as early as 1886 when a bird was shot at Kai-iwi, and in 1892 when one was seen at Hokitika. About 1932 a few birds settled near Invercargill and commenced breeding. Five were seen in 1934, about fifteen in 1943 and up to fifty in 1946, since which time the number of birds is reported to be steadily increasing. Mrs. Olga Sansom estimates that there were about a hundred birds in 1950 and in 1953 about two hundred birds.

Adult. Crown of head black, extending backwards and joining a black patch on the sides of the breast; upper surface from shoulders to rump and wings olive brown; primaries and their coverts black, the primaries brown at the tips; greater coverts with narrow edging of white; secondaries black with



New River Ferry *F. Preddy*

SPUR-WINGED PLOVER

white on the inner webs; upper tail coverts white: tail white with a broad subterminal black band and white or greyish tips to the outer feathers. Base of forehead, sides of face and under surface white. Bill, wattles, irides and wing spur canary yellow. Feet dark crimson. Bill 35, wing 247, tail 105, tarsus 80, mid toe 30 mm. *Fledgling.* Crown black lightly barred with brown; remainder of upper surface barred black, brown and dark buff. Collar round neck and under surface white; a black patch on the sides of the breast. Wattle yellow, small. In the *nestling* the upper surface is buff mottled with black; a band of black on nape above a white collar; lower surface white. A yellow wattle in front of eye. Bill and feet slaty blue.

Eggs. Clutch three or four, pyriform, green, heavily blotched with light and dark purplish brown, 50 x 36, 48 x 35 mm. Australia.

Status. Related to the lesser masked plover of Australia (*L. miles*) which differs in having the sides of the chest brown, and a complete white collar but no black band on the hind neck. The wattles are differently shaped.

Distribution. Well established in Southland. Breeding at Lake Wanaka, New River Ferry, Awarua and Wallacetown; and extending its range up the New River, to the Aparima River, Waituna Lagoon, and in the Gore district. Single birds have been recorded from Pahautea and Kahutara (Wairarapa), Waitotara, Kai-iwi, Wanganui estuary, Waimakariri River, Lake Ellesmere, Grey valley, Hokitika and Campbell Island.

South Australia, eastern Australia, Tasmania.

Habits. The following notes have been supplied me by Mr. J. M. Cunningham: In south-eastern Australia the Spur-winged

Plover is frequently found in open swampy localities. Large flocks of up to 300 birds, which sometimes move by night, may often be seen in winter. In Tasmania it was somewhat rare about the beginning of the present century, but is now an exceedingly common and well distributed species, its increase no doubt being largely due to the progressive clearing of the land. It comes into city parks and suburban gardens, and may be seen in light forest, on the seashore, and around swamps, but its main habitat is the undulating grasslands. A little dry grass is sometimes used for the lining of the nest, which is placed on the ground; four eggs form the usual clutch. Incubation takes about 28 days, and the empty egg-shells are removed by the parents. The chicks leave the nest soon after hatching. Intruders near nest or young are greeted by a distractive display, and the plovers will attack man, dog or predatory bird by diving at them with great boldness, occasionally doing damage with their bony wing spurs which, being about half an inch long, may penetrate clothing. The food of the Spur-winged Plover consists mainly of insects and crustacea, and in periods of drought a great many die of starvation owing to the absence of ground insects.

Nesting in New Zealand. Mrs. Olga Sansom, who has been watching the Spur-winged Plover in the vicinity of Invercargill for several years, has kindly supplied me with the following information. In 1947 two nests each containing two eggs were found. In 1950 Mr. W. Fosbender found a nest with three eggs and ten days later saw three chicks. On Mr. Fosbender approaching the nest the birds made vicious dives at his head. A nest with young chicks was found by Mr. R. Royds about October 28th, 1951. A nest containing three eggs was examined by Mrs. Sansom at New River estuary on September 15th, 1952. The nest was a shallow depression sparsely lined with grass and placed on a small lump of soil in a damp area with swamp about a hundred yards away.

Mrs. Sansom says that Spur-winged Plovers can hold their own with harriers. Mr. Moffet told her that he saw a plover attack a harrier in a swift parallel flight, then swoop round and strike from behind. Feathers flew and the harrier made a quick retreat.

References.—Stephens, Shaw's Gen. Zool., 11, 516, 1819 (*Vanellus novaehollandiae,* New South Wales). Buller, Birds N.Z., 2nd ed., 2, 13, 1888. Sansom, Notornis 4, 138, 1951.

FAMILY SCOLOPACIDAE
SNIPE, SANDPIPERS, CURLEW

Bill slender, not swollen distally, slightly compressed at base; interramal space and nasal depression pointed in front. Tarsi scutellate in front. Hind toe present (except Crocethia).

The distinctive feature of this family is the character of the bill which is long and slender, nearly parallel sided and deeper than wide at the base. It is scarcely different from Phalaropodidae, but is easily distinguished from Recurvirostridae which has a depressed bill and reticulate tarsi. Charadriidae differs in the bill being relatively stout and short.

Key to New Zealand Subfamilies and Genera

Toes cleft to the base.
Tip of upper mandible with inferior angle beyond tip of lower mandible; tarsus shorter than middle toe and claw (Scolopacinae).
Tarsus scutellate in front and behind .... *Capella*
Tarsus scutellate in front, reticulate behind .... *Coenocorypha*
Tip of upper mandible without inferior angle; tarsus equal to or longer than middle toe and claw (Calidriinae).
Hind toe present .... *Calidris*
No hind toe .... *Crocethia*
Toes webbed at base (Tringinae).
Bill straight or slightly upturned.
Bill much longer than tarsus .... *Limosa*
Bill about equal to tarsus.
Plumage spotted above.

Webs on outer and inner toes *Xenus*
No web on outer toe .... *Tringa*
Plumage uniform above ...... *Heteroscelus*
Bill arched .... *Numenius*

GENUS CAPELLA

Bill much longer than tarsus, the tip with an inferior angle beyond the tip of the lower mandible. Tarsus scutellate in front and behind. Toes cleft to the base, hind toe present.

The snipes of this genus differ from the woodcocks (Scolopax) and New Zealand semi-woodcocks (Coenocorypha) in the tarsi being scutellate both in front and behind. Capella is accidental only in New Zealand.

References.—Frenzel, Beschr. Vog. Wit., 28, 1801 (*Capella,* type *Scolopax gallinago* L.). Koch, Sys. bai. Zool., 312, 1816 (*Gallinago,* type *Scolopax gallinago* L.)

Japanese Snipe

Capella hardwickii

The Japanese Snipe is a regular visitor to Australia and Tasmania but has only four times been recorded in New Zealand. A specimen was shot by C. C. Sandford in March, 1898, in a field near Arch Hill on the western side of Auckland. Recognising the bird as a stranger, Sandford took it to the Auckland Museum where it is now preserved. The second specimen was shot by G. Shepherd at Castlecliff in 1914. A snipe, probably this species, was seen by Professor Marples near Taieri beach in January, 1941, and again in January, 1942.

Adult. Upper surface dark brown barred and mottled with ochreous buff. Top of head black with a central and two lateral longitudinal bands of sandy buff; quills dark brown with white tips, the outer web of the first primary mottled with buff, innermost secondaries black, barred with ochreous buff. Central tail feathers black with a broad subterminal bar of rufous lined with black and tipped with white, outer feathers mostly buffy white. Throat and sides of face buffy white; a dark brown line from the bill through the eye; front and sides of neck ochreous buff barred with brown; middle of abdomen white; sides of body barred with brown and white; under tail coverts sandy buff barred with brown. Bill black. Iris brown. Feet brown. Bill 72, wing 157, tail 70, tarsus 37 mm.

Eggs. Clutch three or four, pale stone colour with dark and light purplish red spots all over but more numerous at the larger end, 45 x 30.5, 43.5 x 31 mm. Japan.

Status. Allied to *C. gallinago* but larger, the markings more buff than rufous, and the tail composed of 18 feathers and more evenly rounded.

Distribution. Four occurrences. Auckland. Castlecliff. Taieri Beach (sight record). Ahuriri Lagoon (sight record, D. Brathwaite). Mr. G. Shepherd informed me that this species was seen at Castlecliff during several years, always in the spring. A snipe seen by A. M. Gwynn on Macquarie Island probably belonged to this species. Breeding in Japan, and migrating thence in the northern winter to Australia and Tasmania. Accidental in Lord Howe Island. The Japanese Snipe arrives in Tasmania during September and leaves again during March. It is a common and regular southern summer visitor to Eastern Australia and Tasmania. During the past hundred years the number of this snipe visiting Tasmania has noticeably decreased.

Habits. One of the breeding places of the Japanese Snipe is the open grassy slopes of the volcano Fujiyama in Japan. Here the ground is composed of cinders and ashes and is very dry. The nests are placed on this dry mountain side sometimes a mile and a half from water. The parents attempt to distract the attention of intruders by feigning injury and if the young are disturbed they remove them.

References.—Gray, Zool. Misc., 16, 1831 (*Scolopax hardwickii,* Tasmania). Cheeseman, Trans. N.Z. Inst., 31, 105, 1899. Mathews and Iredale, Man. Birds Austr., 1, 121, 1921.

GENUS COENOCORYPHA

Bill much longer than tarsus, the tip with an inferior angle beyond the tip of the lower mandible. Tarsus scutellate in front, reticulate behind, toes cleft to the base. Hind toe strong, elevated.

The above definition would cover Scolopax, but the New Zealand species here included differ in the colour bands on the head being longitudinal instead of transverse and in several skeletal features, an important one being the incomplete orbital ring.

Coenocorypha is confined to New Zealand and includes two species with several subspecies. In the subfamily Scolopacinae the colour pattern is similar throughout and specific differences are smaller than in most genera of birds.

Key to Species and Subspecies

- Lower breast and abdomen buffy white; bill 42-47 mm. Chatham Is. .... *C. pusilla*
- Under surface mostly barred or blotched; bill 51-64 mm.
  - Under surface barred throughout. Snares Is. .... *C. a. huegeli*
  - Lower abdomen and flanks barred.
    - Throat buffy white with faint spots; Little Barrier Id. .... *C. a. barrierensis*
    - Throat spotted. Stewart Id. ... *C. a. iredalei*
  - Flanks only barred.
    - Plumage lighter. Auckland Is. .... *C. a. aucklandica*
    - Plumage darker. Antipodes Id. .... *C. a. meinertzhageni*

Reference.—Gray, Cat. Gen. Birds, 119, 1855 (*Coenocorypha*, type *Gallinago aucklandica*, Gray).

Chatham Island Snipe

Coenocorypha pusilla

In 1868 this small snipe was collected at the Chatham Islands by Charles Traill. A specimen subsequently came into the hands of Buller who characterised it as a new species. In 1871 Travers visited the Chatham Islands and collected a number of specimens. He found the species on Mangere Island, where it was common, but nowhere else.

Adult. Top of head striped black and reddish brown, remainder of upper surface dark rufous brown, irregularly variegated and spotted with black and with the feathers margined with fulvous or buff; quills brown. Sides of head buff spotted with dark brown; a dark brown line from gape to eye. Chin buff. Foreneck, upper breast and sides of body buff blotched with dark brown. Lower breast and abdomen buffy white. Bill greyish brown. Iris dark brown. Feet pale brown. Bill 42-47, wing 94-102, tail 33-38, tarsus 19-25, mid toe 27-30 mm. The *immature* differs from the adult in the black blotches being less developed giving the plumage a lighter appearance. Feet bluish grey. The *nestling* is rufous brown mottled with dusky with a brownish black line on the head; sides of face silvery grey; throat rufous brown, rest of under surface paler. Bill and feet slate colour.

Eggs. Clutch three, ovoid, light brown with dark and light brown spots, lines and blotches sparsely distributed all over, more crowded near the widest part, 37 x 28.5, 38.5 x 29 mm.

Status. The Chatham Island Snipe is characterised by its smaller size and under surface without blotches. In its upper surface coloration it resembles *C. a. aucklandica.*

Distribution. Chatham Islands. South East Island, common. In the latter part of the nineteenth century it was collected on Mangere and Pitt Islands but it no longer exists in those localities.

Habitat. Travers states that this snipe seldom flies and then only for a short distance. It lives in holes in the rocks, coming out in the evening to feed. According to Hawkins it hides in hollow trees and in thick undergrowth during the daytime. When Fleming visited South East Island in 1937 he occasionally found a pair of snipe in the darkest portions of the bush. They were remarkably tame and could be approached without being disturbed. Their flight was fast and fairly strong but they did not fly farther than about twenty feet.

Concurrently with the spread of European settlement the Chatham Island Snipe has gradually disappeared until now it survives only on South East Island where, however, it is quite common.

Food. "Its chief food is worms and grubs, for which it scratches the ground in the same manner as a fowl; from this habit the settlers have given it the name of chicken bird" (Travers). "It feeds at night and makes a twittering sound while so doing. When the young are first hatched they feed in the daytime, but in about a week they feed at night" (Hawkins). "The long sensitive bill would be buried in the soft humus and would prod vigorously for insect larvae" (Fleming).

Voice. "The cry of this species is more frequently heard in the evening than in the daytime. It may be described as beginning as soft, low, sibilant 'chirrups' and quickly working up to a series of sharp, toneful whistles on high B repeated about eight or ten times in about five seconds" (Fleming).

Nesting. The first collectors who took eggs of this species recorded nothing about its nesting habits. Fleming, in 1937, saw no nests but was told that nests had been found beneath roots of trees and under fallen trunks.

References.—Buller, Ibis, 1869, p. 41 (*Gallinago pusilla,* Chatham Is.). Forbes, Ibis, 1893, p. 529. Buller, Birds N.Z., 2nd ed., 2, 33, 1888. Meinertzhagen Ibis, 1926, p. 516. Fleming, Emu, 38, 495, 1939.

Little Barrier Snipe

Coenocorypha aucklandica barrierensis

n. subsp.

About 1870 two snipe were seen on Little Barrier Island by Captain Bennett of the schooner *Mary Ann.* One was captured alive but died in captivity, the other escaped. The captured specimen was presented to the Auckland Museum by Mr. T. B. Hill and is the basis of the following account. Snipe, possibly belonging to this subspecies, were reported as having been seen by Mr. J. Baker earlier in the century on the shore of Hobson Bay, Waitemata Harbour.

Adult. Above rufous brown, the feathers blotched with blackish brown and sometimes, most noticeable on the scapulars and wing coverts, margined with buff; sides of head light buff spotted with dark brown; lores dark brown; quills brown the outer webs faintly variegated with buff; tail barred rufous and dark brown. Chin and throat buffy white with faint brown spots; foreneck, breast and upper abdomen variegated brown and buff, the brown showing in crescents within the tips of the feathers; lower abdomen buffy white, the flanks barred brown and white; under tail coverts barred dark brown and buffy white. Bill 51, wing 103, tail 32, tarsus 21, mid toe 31 mm.

Status. Differs from *C. a. iredalei* in the greater area of buffy white on chin and throat, the absence of bars on the lower abdomen, the crescent-shaped markings on the upper abdomen and the less rufous general coloration.

Distribution. Little Barrier Island. Extinct.

Reference.—Hutton, Proc. N.Z. Inst., 3, 86, 1871.

Stewart Island Snipe

Coenocorypha aucklandica iredalei

The snipe on the outliers of Stewart Island have been the subject of infrequent investigations by ornithologists. Guthrie-Smith visited Big South Cape Island in 1913 and found snipe but no wekas. Ten years later he found wekas plentiful in the bush and the snipe on the tops. Richdale

Islands off Stewart Island *L. E. Richdale*

STEWART ISLAND SNIPE

visited the island twenty years after Guthrie-Smith's second trip and found few wekas and few snipe. On Jacky Lee Island, off the east coast, snipe were formerly found and it was here that the type of the subspecies *iredalei* was collected. The snipe were subsequently exterminated on Jacky Lee Island by introduced wekas.

Adult. Differs from the Snares Snipe by the upper surface being more rufous, the under surface lighter and the chin buffy white. Bill 51-59, wing 102-104, tail 32, tarsus 23-26, mid toe 30 mm.

Eggs. Clutch two, oval, light or very pale brown with dark and pale brown spots and small blotches all over but with concentration near the larger end. 38.5 x 28.4, 40 x 28.6, 41 x 32 mm. Big South Cape Island.

Distribution. Islands off Stewart Island. Big South Cape Island. Jacky Lee Island (now extinct).

Habits. On Big South Cape Island, southwest of Stewart Island, Guthrie-Smith stated that "the nest was of the most simple construction, hardly more than an indentation on the thickly scattered brown dracophyllum needles. Another nest on granite grit and sand thickly littered with dracophyllum needles was piled a couple of inches high with moss, softest lichen and frayed lissom manuka twiglets. The eggs are two in number. Of the five pairs of mature birds we knew and were always sure to find each in its own domain, not one possessed more than a single chick. When pair after pair both in the valley and on the tops were found with only a single chick we came to think it must be the custom of the impatient little mother immediately to leave the nest with her one youngster able to follow. Snipe began to lay about the end of October and continue during early November. Both male and female sit. They trust to concealment, not to flight. There were no signs however faint of ability or desire to fly. A low hoarse double croak is uttered from time to time as the pair or trio irregularly progress always probing. Each minute red worm could upon withdrawal of the bill always be seen dangling at its extremity ere being passed downward and swallowed. They feed also on small chrysalis-like objects on the surface."

Richdale, who also visited Big South Cape Island, records, as with the Snares Snipe, the habit of moving slowly over the ground with the bill pointed downward and with the head on one side. He continues: "Rarely does it fly, although it will do so if sufficiently alarmed. The species probably lays in October when two eggs appear in a nest on the ground under the flattened and thick vegetation above the bush line."

References.—Rothschild Bull. Br. Orn. Club, 41, 63, 1921 (*Coenocorypha aucklandica iredalei,* Jacky Lee Id.). Guthrie-Smith, Sorrows Joys N.Z. Nat., 174, 1936.

Snares Island Snipe

Coenocorypha aucklandica huegeli

The first specimen of a snipe to be obtained from the Snares was taken as early as 1873, and Chapman found them to be plentiful in the group in 1890. They were, however, not described as a distinct species until 1893. Opportunities to camp on the Snares and study the birds came to E. F. Stead and others in 1947 and to L. E. Richdale in 1948.

Adult. Upper surface dark rufous brown irregularly variegated and spotted with black and with the feathers margined with fulvous or buff; quills brown, the outer webs faintly variegated with buff. Sides of head buffy white spotted with dark brown; a dark brown band from gape to eye. Chin buffy white; foreneck and breast buff with longitudinal marks of dark brown; abdomen buffy white barred with dark brown. Bill greyish brown, the base of the lower mandible yellowish. Iris dark brown. Feet greyish brown. Bill 53-57, wing 102-109, tail 40-43, tarsus 23-24, mid toe 33 mm. The *immature* differs from the adult in the more minutely spotted and barred coloration, with the ground colour more fulvous on the head and under surface. The *nestling* is "brown variegated with lighter" (Buller).

Eggs. Clutch two, ovoid, greyish white to pale brownish buff, with reddish brown and bluish grey spots and blotches all over or mostly at the larger end. 41 x 31, 43 x 32, 45 x 32 mm.

Status. The Snares Island snipe is distinguished by the under surface being barred all over which is not the case with any other subspecies. The general colour also is more reddish than in the others. The snipe found in the islands off Stewart Island are partly barred below but are more rufous above and more buffy below than the Snares Snipe.

Distribution. Snares Islands. Semi-fossil bones near to this subspecies have been found at Lake Grassmere, Marlborough, by R. J. Scarlett.

Habits. An account of the Snares Snipe has been published by E. F. Stead who spent two weeks on the main island in December, 1947. "When flushed in the daytime it runs for a few feet then stands still silently regarding the intruder. They are reluctant to fly during the daytime and when they do it is not for more than ten or fifteen yards and often for only two or three. At night they fly more readily and for considerable distances. Their food apparently consists chiefly of worms. Always snipe are to be found on the outskirts of penguin colonies. Their laying season commenced at the beginning of December. Nests were found in the heart of big tussocks of *Poa foliosa* about one foot above ground level. The nests were deep cups of fine grass 9½ cm. wide by 7 cm. deep, and contained a good deal of material."

Richdale visited the Snares soon after Stead was there and stayed for six weeks. He says the snipe "moves slowly over the ground with bill pointed downwards and with the head on one side. The nest is made on the ground under some solid vegetation or hollow end of a small tree trunk. The chicks can run soon after they are hatched and follow the parents long after they are fully fledged. Never at any time did we see more than one chick with one parent."

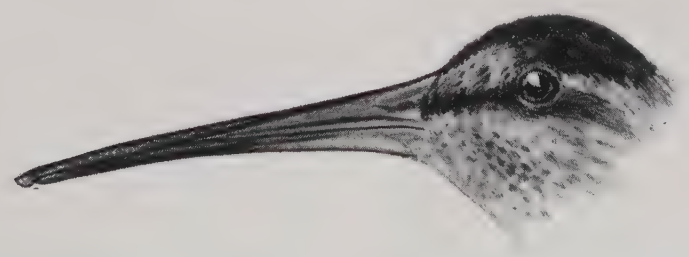
References.—Tristram, Bull. Br. Orn. Club, 1, 47, 1893 (*Gallinago huegeli,* Snares). Buller, Birds N.Z., ed. 2, vol. 2, col. pl., *G. pusilla,* 1888; Suppl. Birds N.Z., 1, 189, 1905. Stead, N.Z. Bird Notes, 3, 73, 1948. Richdale, Wild Life Island Outpost, 114, 1948.

Auckland Island Snipe

Coenocorypha aucklandica aucklandica

Both the American expedition under Charles Wilkes and the British expedition under Sir James Ross, which visited the Auckland Islands in 1840, obtained specimens of this species. The British specimens were described first by Gray, in his report of the birds collected by the *Erebus* and *Terror.*

Adult. Top of head dark brown with a few buff feathers mostly in the mid line. Remainder of upper surface dark rufous brown irregularly variegated and spotted with black and with the feathers margined with fulvous or buff; primaries brown with narrow edging of buff; sides of head buff, spotted with dark brown; a dark brown line from gape to eye. Chin buff; foreneck, breast and sides of body buff with longitudinal spots and blotches of dark brown; abdomen buff. Bill greyish brown. Iris hazel. Feet brownish yellow.



Lily A. Daff

AUCKLAND ISLAND SNIPE

Bill 51-64, wing 102-114, tail 34-38, tarsus 22-27, mid toe 28-32 mm. The *immature* differs from the adult in having the breast and sides of body more minutely spotted with brown. The wing coverts are also not so boldly marked. The *nestling* is dark brown with greyish buff tips to the down, a blackish brown line on head, middle of under surface greyish white.

Egg. Ovoid, pointed, greenish stone with numerous dark and light brown blotches all over, 51 x 35 mm.

Status. C. a. aucklandica is larger than *C. pusilla* and more fulvous on the under surface. It is distinguished from *C. a. huegeli* by the absence of brown bars on the abdomen.

Distribution. Auckland Islands, formerly on the main island but now found only on Ewing and Adams Islands.

Habits. This snipe frequents the tussock and scrub of the Auckland Islands. It runs quickly, and if hard pressed makes short flights and disappears under the dense scrub where it is impossible to follow it.

References.—Gray, Zool., Erebus and Terror, Birds, 13, col. pl., 1845 (*Gallinago aucklandica,* Auckland Is.). Buller, Birds N.Z., 196, 1872; 2nd ed., 2, 32, 1888.

Antipodes Island Snipe

Coenocorypha aucklandica meinertzhagenae

The Antipodes Island Snipe was first collected by Fairchild in 1887, and by Reischek in 1888.

Adult. Similar to the Auckland Island Snipe but darker above and with the under surface more yellow. Bill 59-61, wing 107, tail 36, tarsus 28 mm.

Distribution. Antipodes Island.

Habits. A single bird was seen by Capt. G. M. Turner and myself near the top of Mount Galloway in April, 1927. It flew two or three yards, ran a foot or two, made a second short flight, then ran and finally flew into some scrub and was not seen again.

References.—Rothschild, Bull. Br. Orn. Club, 3, 12, 1893 (*Gallinago tristrami,* Antipodes Id.); Nov. Zool., 34, 15, 1927 (*C. a. meinertzhagenae,* Antipodes Id.).

GENUS CALIDRIS

Bill straight or arched, equal to or longer than tarsus. Tail square (*C. canutus*), or rounded or doubly emarginate with two central feathers projecting. Toes cleft to the base. Hind toe small.

About fourteen species of small grey plumaged birds breeding in the northern hemisphere and migrating southwards in the northern winter.

Key to New Zealand Species

- Tail square (Subg. *Calidris*) .... *C. canutus*
- Tail with central feathers projecting.
  - Bill straight, tip downcurved (Subg. *Pisobia*)
    - Larger, wing over 120 mm.
      - Shaft of outer primary white, others white at base only .... *C. melanotos*
      - Shafts of all primaries subterminally white .... *C. acuminata*
    - Smaller, wing under 110 mm.
      - Feet black .... *C. ruficollis*
      - Feet yellow .... *C. minutilla*
  - Bill arched, tip not downcurved (Subg. *Erolia*) .... *C. testacea*

References.—Merrem, Allg. Lit. Zeit., 2, 542, 1804 (*Calidris,* type *Tringa canutus* L.). Vieillot, Anal. Nouv. Orn., 55, 1816 (*Erolia,* type *Scolopax testacea* Vroeg.). Billberg, Syn. Faun. Scand., 1, 136, 1828 (*Pisobia,* type *Tringa minuta* Leisler.)

Eastern Knot. Huahou

Calidris canutus rogersi

The Knot is a regular summer visitor to New Zealand favouring the North rather than the South Island. Several specimens were taken in the South Island prior to 1865 but the first specimen obtained in the North Island was shot on Ninety-mile Beach in 1874.

Adult—Summer Plumage. Top of head black, the feathers edged with chestnut; hind neck grey; back and scapulars black, the feathers edged or twin-spotted with chestnut; wing coverts pale brown, tipped with white; primary coverts dark brown tipped with white; primaries dark brown with white shafts and black tips; secondaries pale brown with white tips; rump grey with white tips to the feathers; upper tail coverts white tinged with chestnut and barred with black; tail grey. Sides of face and head, and under surface chestnut; abdomen white. Bill black. Iris brown. Feet olive-brown. Bill 31-36.5, wing 152-174, tail 60-66, tarsus 30-33, mid toe 20-23 mm. The *winter* plumage is ash-grey above, the feathers with black shafts and pale edges; wings as in the summer plumage; upper tail coverts white, barred with dark brown. Sides of face and under surface white, with pale brown streaks on the sides of face and breast, and frecklings of pale brown on the lower breast and sides of body, a few only on the abdomen. *Immature* similar to the adult in winter but the feathers of the back and wings brown with black submarginal lines edged with white, a tinge of buff on the throat, breast and sides of body. The *nestling* has the forehead buff with back lines, upper surface black varied with rufous and dotted with buff; under surface buff. *Colour variety.* An albino was once observed at Manukau Harbour by Cheeseman.

Eggs. Clutch four, greenish grey with small dark and light reddish brown spots and blotches scattered all over; sometimes there are large blotches chiefly at the larger end, 42 x 31.7, 43 x 31, 44.3 x 31.1 mm. New Siberia.

Status. Three subspecies, European (*C. c. canutus*), Eastern Asiatic (*C. c. rogersi*), and American (*C. c. rufus*), have been defined. The Eastern Asiatic form visits Australia and New Zealand. *C. canutus* differs from the great knot in the bill being shorter, the under surface chestnut in summer instead of white, and the upper tail coverts barred.

Distribution. Kermadec Islands: accidental on spring migration. North and South Islands as far south as Lake Ellesmere and Warrington, Otago; large numbers congregate during the summer months in Kaipara Harbour, Manukau Harbour and Firth of Thames; recorded in smaller numbers in Parengarenga Harbour, where it frequently winters, Ninety Mile Beach, Mangowai and other localities north of Auckland, Kawhia, Ohiwa Harbour, Pauatahanui, Lake Wairarapa, Cape Farewell, Pelorus Sound, Lake Ellesmere, Stewart Island. Chatham Islands. Accidentally in Campbell and Macquarie Islands.

Breeding in the Arctic regions of Siberia and Alaska and migrating thence in the northern winter to Australia and New Zealand. Accidental in Lord Howe Island on spring migration. The Knot arrives in the Siberian tundra in June and leaves again during August in family parties or the adults preceding the young. It arrives in New Zealand in September and October and leaves for the north in April. Considerable numbers stay in New Zealand for the winter. A specimen was taken at Lord Howe Island on September 10th and another at Sunday Island on October 17th.

Habits. In New Zealand the Knot frequents the intertidal mud and sand flats and lagoons near the coast, feeding on the abundant animal life that is found in such places, and associating with godwits, turnstones and golden plovers. According to Stead they are very thin when they arrive in New Zealand but become very fat by the time they are ready to fly north. The birds observed in New Zealand are nearly all in the winter plumage, but a few change to the summer garb before leaving the country.

When the Knot arrives in the Siberian tundra the snow still lies in places. However, it immediately begins to prepare its nest and perform its aerial courtship evolutions which are not deterred even by a thick fog. The nest is usually placed on the slope of a hill where a slight hollow in the turf is made, and lined with lichen. On the nest being approached, the birds feign lameness in order to decoy away the intruder. The eggs are laid in June and the young hatched early in July and immediately conducted from the barren hillsides to the lower ground where insects abound. When the adult birds are protecting the young they do not feign lameness but approach the enemy and then fly straight away. The period of incubation and growth to adult size is rapidly passed through in the Knot as in other migrants breeding in the Arctic regions. Incubation takes about 20 days and when three weeks old, the young Knot is almost full grown and is half fledged. They migrate as soon as they are able to fly.

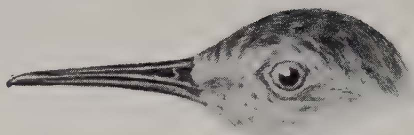
References.—Linne, Syst. Nat., 10th ed., 150, 1758 (*Tringa canutus,* Sweden). Buller, Birds N.Z., 194, 1872; 2nd ed., 2, 35, 1888. Pleske, Mem. Boston Soc. Nat. Hist., 6, 265, col. pl., 1928. Mathews, Birds Austr., 3, 270, 1913 (*Canutus c. rogersi,* Japan).

Pectoral Sandpiper

Calidris melanotos

The proper range of this species is America, breeding in the Arctic regions and migrating southwards but it also is found in Arctic Asia. In New Zealand it has been taken on Lake Ellesmere on several occasions, most of the specimens falling to the gun of E. F. Stead, the first being obtained in 1903.

Adult. Upper surface light drab streaked and spotted with black; margins of scapulars ringed with cinnamon. Wing coverts drab margined with paler; quills brown, margined with paler; shaft of outermost quill entirely white, shafts of other quills pale brown but white at base; rump and upper tail coverts black, the feathers margined with brown. Central tail feathers dark brown, margined with greyish brown, the outer ones greyish brown edged with paler. Superciliary streak dull white, streaked with dusky. Lores greyish brown. Sides of face, neck all round and chest greyish brown streaked with dusky. Chin, throat and rest of under surface white. Bill blackish brown, yellow at base. Iris dark hazel. Feet ochraceous yellow. Bill 24-29, wing 120-146, tail 51-65, tarsus 24-30, mid toe 21-27 mm. In winter the cinnamon tinge in the scapular region is absent. *Immature.* Differs from adult in feathers of scapular region being edged with white, and the chest being more buffy and more narrowly streaked. *Nestling.* Top of the head buffy brown blotched with dark chestnut, black and white; upper surface greyish buff mottled with black and chestnut; under surface buffy white, brown on the chest.



Lily A. Daff

PECTORAL SANDPIPER

Eggs. Clutch two, ovoid, olivaceous buff with blackish brown spots grouped chiefly at the larger end, 41 x 28.8, 42.1 x 28.7.

Status. This species differs from *C. acuminata* by being slightly larger, by the presence of a broad band of grey streaked with brown on the throat and upper breast, and by the outer primary having a white shaft. The crown is also less rufous. The tail is doubly emarginate.

Distribution. A regular summer migrant to New Zealand. Firth of Thames, several records. Waitotara, Masterton, Porangahau, Napier, Appleby. Lake Ellesmere, several records. It has been noted in New Zealand every month from September to March. All birds seen in New Zealand have been in winter plumage.

Breeding in Arctic America and northeast Siberia, and migrating southward mainly to South America. The Pectoral Sandpiper arrives in the Arctic regions in May and early June and leaves in August. In the Argentine it is fairly common between September and March. Straggler to Australia.

Habits. Describing the breeding habits of this species at Hooper Bay, Alaska, H. W. Brandt writes: "The Pectoral Sandpiper usually chooses for its homesite the upland rolling tundra. The birds showed exceptional skill in the concealment of their homes, for they chose a tract where the curly bunchgrass grew abundantly, and under its domed protection they constructed an excavation deep in the moss. Here a substantial nest is fashioned of grasses and tediously lined or rather filled with small crisp leaves of the low perennial plants that in a dwarf creeping form, are the only representatives of the great inland forests."

The food of the Pectoral Sandpiper in Alaska consists of insects, crustacea, spiders, seeds and other vegetable matter including algae.

References.—Vieillot, Nouv. Dict. Hist. Nat., 34, 462, 1819 (*Tringa melanotos,* Paraguay). Bent, Bull. U.S. Nat. Mus., 142, 169, 1927 (*Pisobia maculata*). Stead, Trans. N.Z. Inst., 54, 491, 1923. Sibson, Emu, 43, 137, 1943.

Sharp-tailed Sandpiper. Kohutapu

Calidris acuminata

Probably a regular visitor to New Zealand, this species was first taken at Lake Ellesmere in December, 1871. Several specimens have since been taken in New Zealand and in October, 1908, I shot one at Raoul Island, the first record for the Kermadec Group.

Adult. Top of head rufous brown streaked with black; hind neck buffy, streaked with dusky; feathers of back and scapulars black, broadly edged with brown; wing coverts grey-brown with paler margins, the greater series edged with white; primaries greyish brown edged with paler, the shafts subterminally white; secondaries dark brown edged with greyish white and brown; rump and upper tail coverts blackish brown margined with paler; central pair of tail feathers blackish brown margined with rufescent, remainder greyish brown margined with white. Side of head and neck white streaked with dusky; chin and throat white; foreneck and chest cinnamon buff, irregularly streaked and spotted with dusky; rest of under parts white, the sides with greyish brown streaks. Bill black. Iris brown. Feet greenish yellow. Bill 24-28, wing 120-138, tail 50-60, tarsus 28-31, mid toe 23-30 mm. In winter the plumage is less rufescent above, the top of the head, however, distinctly rufescent; the chest pale greyish buff streaked with dusky. The *immature* differs from the adult in having the top of the head bright rusty brown streaked with black; more rusty ochraceous colour on the feathers of the back, scapulars, and upper tail coverts; foreneck and chest rusty buff narrowly streaked with dusky.

Status. Differs from the Pectoral Sandpiper in the more rufescent upper surface, paler chest and different disposition of white on the primary shafts. Tail wedge shaped.

Distribution. Apparently a regular summer visitor though in small numbers from October to March. One was seen by H. R. McKenzie in the Firth of Thames on July 31st. Localities where the species has been recorded are the Kermadec Islands, Parengarenga Harbour, Manukau Harbour, Firth of Thames, Bay of Plenty, Ahuriri lagoon, Foxton, Ohau River, Masterton, Marlborough, Waipara River and Lake Ellesmere.

Most of the examples taken in New Zealand have been in the winter plumage but a few procured by Stead at Lake Ellesmere in February were in full breeding plumage.

Breeding in North-eastern Siberia; wintering in Malay Archipelago, Australia and New Zealand. Visitor to Lord Howe Island. Irregular visitor to Alaska and accidental in Western Canada and United States, British Isles and Hawaiian Islands. Nothing definite has been recorded regarding the arrival of this species in Siberia. Its southward-bound migration begins in August, in company with the Pectoral Sandpiper. It is common in Australia from September to March.

Habits. In Alaska, the food of this species was found to consist of insects, crustacea, molluscs and vegetable matter. It frequents the seal-killing fields to feed on fly maggots. It is supposed to breed in Eastern Siberia and Mongolia but the nests have never been found.

In North-western Australia the food of the Sharp-tailed Sandpiper has been found to consist of insects, mollusca and seeds.

References.—Horsfield, Trans. Linn. Soc., 13, 192, 1821 (*Totanus acuminatus,* Java). Buller, Birds N.Z., 2nd ed., 2, 37, 1888.

Red-necked Stint

Calidris ruficollis

The Red-necked Stint which breeds in Siberia and Alaska is possibly a regular visitor to New Zealand. It was first obtained in New Zealand at Lake Ellesmere in 1902, by E. F. Stead. The same year a specimen was taken at Taieri Flat, Otago. Since that time several more examples have been taken at Lake Ellesmere, one at Waikanae in 1930, and several have been seen in the last ten years at Manukau Harbour and the Firth of Thames.

Adult—Summer Plumage. Head, neck all round and back rufous with black centres to the feathers; wing coverts dark brown, the greater series tipped with white; quills dark brown with white shafts, the long inner secondaries with chestnut margins; rump and upper tail coverts dark brown, the feathers edged with white, the long central upper tail coverts black; middle tail feathers dark brown, outer pale grey. Base of forehead and chin whitish; breast and abdomen white, the sides of the breast flecked with dusky. Bill black. Iris brown. Feet black. Bill 16-18, wing 92-104, tail 39-47, tarsus 18-20, mid toe 19-20 mm. In *winter* the upper surface is light grey, top of head and back streaked with black; wings and tail as in summer; sides of forehead and face and under surface white; sides of chest greyish. The *immature* has the upper surface pale brownish grey, top of head, back and scapulars streaked with black, the long scapulars darker and narrowly edged with white; wings, rump and tail as in adult; forehead, lower part of face and under surface white; the chest shaded with brownish grey. The *nestling,* on the upper surface, is variegated with black, tawny and buff; a black stripe on the forehead and lores; forehead, superciliary streak and sides of head and neck buff; under surface white; pale buff on the breast.

Status. Differs from *C. minuta* in summer by the throat and foreneck being rufous instead of white, and in winter by the upper surface being lighter.

Lake Ellesmere *L. A. Shand*

RED-NECKED STINT

Distribution. Known to visit New Zealand fairly regularly from October to April but in small numbers, four being the most that have been seen at one time. One specimen was taken at Lake Ellesmere in July, and two wintered in the Firth of Thames in 1949. In New Zealand the Red-necked Stint appears in winter plumage but birds seen in March, April and July were in summer plumage. Localities where observed: Parengarenga Harbour, Firth of Thames, Manukau Harbour, Waikanae, Lake Ellesmere, Taieri Flat.

Breeds in north-east Siberia and Alaska. Migrates during the northern winter to south-east Asia, Malay Archipelago, New Guinea, Australia and Tasmania. Arrives in eastern Siberia in May and leaves on its southward migration before the middle of September.

Habits. During its stay in New Zealand the Red-necked Stint frequents mud and sand flats and shingle beaches in harbours and estuaries, and lagoons near the sea as at Lake Ellesmere. The Waikanae specimen was taken on an exposed sandy beach. It associates with flocks of wrybill, godwit, banded dotterel and curlew sandpipers.

The only published information relating to the breeding habits of the Red-necked

Stint is a scanty record of a nest in Alaska and two others in Eastern Siberia. In both cases the nest is described as a small cavity lined with willow leaves. It is placed in a tussock (Alaska) or on small mounds of tundra (Siberia). In the Siberian locality, Providence Bay, two clutches of eggs, three and four respectively, were taken on June 11th.

References.—Pallas, Reise. Russ. Reichs., 3, 700, 1776 (*Trynga ruficollis,* Siberia). Stead, Trans. N.Z. Inst., 54, 493, 1923 (*P. ruficollis* and *P. minuta*).

Least Sandpiper

Calidris minutilla

A single individual of the Least Sandpiper or stint was seen by R. H. D. Stidolph on tidal mudflats on the northern side of the Wairoa River, Hawke's Bay, on November 21, 1952. A Least Sandpiper was seen by D. H. Brathwaite at Napier in the summer of 1953-1954.

Adult in summer. Crown streaked buffy brown and black; hindneck more greyish and less distinctly streaked; back and scapulars blackish, the feathers margined with pale fulvous or cinnamon; wing coverts dark greyish brown with paler margins; secondaries dusky margined with white; primaries dusky, all with partly white shafts; rump and median upper tail coverts black; lateral upper tail coverts white with central dusky streak; tail greyish brown, the feathers, except the central pair, with white shafts except terminally; superciliary stripe greyish white; lores greyish brown flecked with dusky; ear coverts greyish brown streaked with dusky. Foreneck, breast and sides of neck and breast pale greyish brown streaked with dusky; rest of under surface white. Bill blackish, legs and feet olivaceous. Bill 16-20, wing 82-91, tail 34-41, tarsus 16-19, mid toe (without claw) 15-17 mm. *Adult in winter.* Upper parts greyish brown, the feathers darker centrally. *Immature.* Similar to adult in summer but feathers of back and scapulars margined with white, wing coverts margined with buffy and chest buffy and indistinctly streaked.

The above descriptions are condensed from Ridgway. Stidolph's description of the bird he saw at Wairoa is as follows: "The bird had a rufous-tinged crown, a russet eye-stripe, russet or tan edges to the wing feathers, much darker, almost black feathers on the back, near-black middle tail feathers, and a russet wash across the chest, the feathers there being streaked darker. The bill was black and the legs and feet yellowish."

Eggs. Clutch four, pyriform, olive buff of different shades, blotched and spotted chiefly at the larger end with brown. 29 x 21 mm. (average).

Status. American ornithologists and the *Handbook of British Birds* treat the Least Sandpiper as a species distinct from *C. subminuta.* It is distinguished from *C. subminuta* by the shorter tarsi and toes and absence of brown on the base of the bill. The systematic position of the birds seen in New Zealand must remain doubtful until a specimen is examined in the hand but the fact that Stidolph described the bill as black indicates that his bird belongs to *minutilla.*

Distribution. Wairoa River. Napier. Breeding in northern North America from Alaska to Newfoundland and migrating southwards, wintering in the southern United States to Galapagos Islands, Brazil and Patagonia.

Habits. The northward migration of the Least Sandpiper takes place in April and May, and the southward migration in July and August. The nest is a depression in the wet moss of a bog or on the dry leaves on ridges, and is usually near water. Incubation is thought to be carried out mostly by the male. The food consists mainly of insects but crustacea, worms, molluscs and seeds of water plants are also eaten.

References.—Vieillot, Nouv. Dict. Hist. Nat., 34, 466, 1819 (*Tringa minutilla,* Nova Scotia). Stidolph, Notornis, 5, 115, 1953. Brathwaite, Notornis, 6, 149, 1955.

Curlew Sandpiper

Caladris testacea

The Curlew Sandpiper is a regular albeit rather scarce visitor to New Zealand. The first example to be taken in New Zealand was shot at Lake Ellesmere in February, 1902. In March of the following year a specimen was obtained at Lake Te Anau. In the North Island it was first noticed by R. B. Sibson in the Firth of Thames in October, 1941.

Adult—Summer Plumage. Upper surface dark brown to dark reddish brown, with black centres and whitish edges to the feathers; lower back greyish brown; upper tail coverts white, barred with black; tail ashy brown, the feathers edged with white; wing coverts dark brown tipped with white; quills dark brown edged with white. Sides of face and under surface chestnut, the feathers more or less edged with white; sides of body white, sparsely barred with black. Bill black. Iris brown. Feet black. Bill 33-42, wing 120-130, tail 44-50, tarsus 28-32, mid toe 19-21 mm. The Winter plumage is similar to the summer plumage, but head, neck, back, scapulars and long inner secondaries greyish brown; superciliary streak, upper tail coverts and under surface white, with lines of dusky brown on the sides of the face and neck and lower throat and foreneck. The *immature* is similar to the adult in winter but scapulars and interscapulars dusky, edged with buff; wing coverts margined with buff and chest buffy. The *nestling* is mottled above with golden buff, red-brown and white; below buffy white, darker on the chest.

Eggs. Clutch four, pyriform, olive-buff, rather heavily blotched, chiefly at the larger end with dark and light reddish brown, 33.3 x 25, 35.2 x 25.8, 36.6 x 25.8, 39.8 x 25.7 mm. Taimyr Strait, Siberia.

Status. The Curlew Sandpiper stands apart from the members of the subgenus Pisobia by reason of its long curved bill. It agrees with them in the structure of the bill and in the two central tail feathers being extended beyond the others.

Distribution. Regular summer visitor in small numbers in winter plumage. Some birds have been obtained in partial summer plumage. Kermadec Islands, Firth of Thames, Lake Ellesmere, Lake Te Anau. According to Allison and Sibson one wintered in the Firth of Thames in 1949.

Breeding in Arctic Asia and migrating thence to Europe, Africa, India, Australia, Tasmania and New Zealand. Visitor to Lord Howe Island. Occasional on both the east and west coasts of North America. The Curlew Sandpiper arrives in the Siberian tundra in June and leaves on its southward migration during August.

Habits. In New Zealand the Curlew Sandpiper associates with Wrybills on the sand and mud flats of the Firth of Thames and with Banded Dotterel on the mud flats of Lake Ellesmere which is a large lagoon near the coast. Stead records having seen between twenty and thirty Curlew Sandpipers in a large company of Banded Dotterel at Lake Ellesmere. It has only once been obtained at an inland station, namely Lake Te Anau in south-western Otago.

According to Birula at Taimyr Strait, the Curlew Sandpiper prefers to place its nest on the gentle southerly slopes of hills and always in the higher parts of the tundra that lose their covering of snow and become dry earliest. The nest consists of a depression in the moss and compacted grass, quite unlined except for the dried moss and a small quantity of lichen. The eggs are laid during the latter part of June. The young leave the breeding ground on their southern flight about the middle of August.

References.—Pallas, Cat. Vog. Adumb., 6, 1764 (*Scolopax testacea,* Holland). Jourdain in Bent, Bull. U.S, Nat. Mus., 142, 232, 1927 (*E. ferruginea*). Pleske, Mem. Bost. Soc. Nat. Hist., 6, 260, 1928.

GENUS CROCETHIA

Bill short, the nasal groove long, reaching almost to the tip. Tarsus scutellate in front and behind, length equal to culmen. Toes cleft to the base; no hind toe.

The presence of a long nasal groove together with the absence of a hind toe serves to distinguish this genus from its allies.

Crocethia includes a single species found in all parts of the world.

Reference.—Billberg, Syn. Faun. Scand., 1, 132, 1828 (*Crocethia,* type *Trynga alba* Vroeg).

Sanderling
Crocethia alba

About twelve examples of this world-wide species have so far been obtained or observed in New Zealand. The first was shot by E. F. Stead at Lake Ellesmere on January 7th, 1917.

Adult—Summer Plumage. Head and neck all round rufous, streaked with brown, a narrow white line below the eye; back and scapulars black, the feathers margined with rufous or white; wing coverts brown, the median and greater series tipped with white; primaries dark brown on the outer webs and tips, inner webs paler; secondaries brown, some of the inner ones almost white; upper tail coverts black with white tips, the long central ones entirely black, central tail feathers dark brown, blackish towards the tips, the outer feathers paler and mottled with brown or white. Chin, breast, abdomen, and under tail coverts white. Bill and feet black. Iris dark brown. Bill 23-28, wing 113-128, tail 45-55, tarsus 23-26, mid toe 20 mm. In *winter* the upper surface of the head and body is pale grey with dark shafts to the feathers; under surface white; otherwise as in summer. The *immature* is similar to the adult in winter but above greyish spotted with white and black; chest more or less tinged with buff. The *nestling* has the forehead buff with a median black line; nape buff; rest of upper surface variegated buff and black and spangled with white; lores buff, with two black lines on each side; under surface white, cheeks, chin and throat light buff.

Eggs. Clutch four, pyriform, deep olive-buff, with dark and pale olive-brown blotches and spots all over but chiefly at larger end, 33 x 24.5, 36 x 25.5, 37.5 x 24.7 mm. Taimyr Strait, Siberia.

Distribution. Parengarenga, Waikanae, Waimakariri lagoon at mouth (3 specimens), Lake Ellesmere (2 specimens), Invercargill.

Breeding in arctic and subarctic regions including Greenland and migrating thence to all parts of the world, wintering mainly south of 40° North latitude. The Sanderling arrives in the Arctic regions during May and June and leaves in August, the adults preceding the young. The times of arrival and departure in Arctic America correspond with those in Siberia. Its winter (southern summer) range extends as far south as Chile, Argentina, South Africa and Australia. It is apparently only accidental in New Zealand as it is in Hawaii.

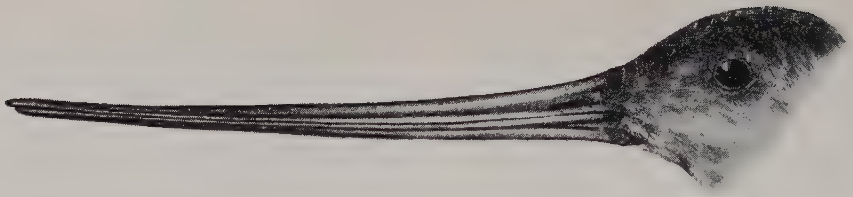
Habits. The Sanderling breeds in the far north, its range including Greenland, Grinnell Land and the New Siberia Islands. It is found in the Aralo-Caspian Desert in summer and is thought to breed there but nests have not been discovered. In the Siberian tundra the nest is a slight depression lined with a few blades of grass and pieces of lichen. The eggs are laid in June and early July, the young grow rapidly and when able to fly are deserted by the adults. They then gather into flocks and lead a wandering existence on the tundra, not going far from the sea shore. According to Birula, all had left the island of New Siberia by the middle of August.

References.—Vroeg, Cat. Ois. Adumb., 7, 1764 (*Trynga alba,* Holland). Bent, Bull. U.S. Nat. Mus., 142, 265, 1927. Pleske, Mem. Bost. Soc. Nat. Hist., 5, 242, col. pl., 1928. Mathews, Birds Austr., 3, 241, col. pl., 1913. Turbott, Notornis, 4, 127, 1951.

Genus Limosa

Bill very long, much exceeding the tarsus, slightly upcurved, nasal groove extending to near the tip. Tarsi scutellate in front and behind. Web at base of outer and middle toes. Hind toe well developed, elevated.

Easily recognised by the very long, slightly upturned bill, long legs and spotted coloration. The genus comprises three species and is found in all parts of the world.



Lily A. Daff

EASTERN BAR-TAILED GODWIT

Key to New Zealand Species

Tail distinctly barred	*L. lapponica*
Tail black with white base and tip	*L. haemastica*

References.—Brisson Orn., 5, 261, 1760 (*Limosa,* type *Scolopax limosa* L.). Mathews, Birds Austr., 3, 191, 1913 (*Vetola,* type *S. lapponica* L.).

Eastern Bar-tailed Godwit. Kuaka

Limosa lapponica baueri

The Godwit, which is a well-known migrant to New Zealand, and whose long annual journeys never fail to excite wonder, was evidently the bird mentioned by Yate in 1835 under the Maori name katatai. It was more definitely recorded about 1840 when Earl collected specimens at Waikouaiti in Otago where he noted that it was found in abundance on the seashore in summer. Colenso mentions seeing Godwit on the shore of Manukau Harbour during his journey from the east coast to the Bay of Islands in 1842. For the next twenty years little was recorded about the Godwit. Then it was frequently mentioned in the writings of Hutton, who obtained a specimen on Great Barrier Island in 1868, and Buller. Travers discovered it at the Chatham Islands in 1871.

Adult male—Summer plumage. Top of head and back and sides of neck chestnut streaked with blackish brown; rest of upper surface of body blackish mottled with chestnut-red with which each feather is notched or margined; wing coverts dark brown with white or chestnut tinged edgings to the feathers; primaries dark brown, inner webs paler and freckled; secondaries brown, edged with white, the inner ones notched with rufous; lower back and rump white, spotted with blackish brown; upper tail coverts black, barred with white or chestnut; tail brown, barred with white or chestnut tinge. Eyebrow and side of face chestnut; lores chestnut, spotted with black; under surface chestnut with blackish streaks on sides of upper breast. Under wing coverts and axillaries white. Bill blackish brown, yellowish brown at base of lower mandible. Iris brown. Feet greyish blue, claws black. Bill 77-86, wing 218-235, tail 73-80, tarsus 49-53, mid toe 29-31 mm. *Adult Female—Summer plumage.* Similar to the male, but not so entirely cinnamon rufous below, and with remains of brown bars on the under surface, especially on the flanks. Bill 87-114, wing 224-240, tail 77-83, tarsus 51-59, mid toe 29-33 mm. *Adult—Winter plumage.* Top of head ashy brown with dark brown centres; rest of head and neck light ashy brown streaked with darker brown, the sides of the face speckled with light brown; rest of upper surface ashy brown with longitudinal black centres to the feathers, and white margins; wings and tail as in the summer plumage but the bars lighter brown; lower back, rump and upper tail coverts white with arrow-shaped marks and bars of brown. Under surface white, with a few streaks of brown on the lower throat and sides of body. *Immature.* Similar to adult in winter but upper surface of body and wing coverts buffy greyish, irregularly spotted with brown; lower surface buffy whitish, shaded on chest with deeper greyish buff. *Nestling.* Upper surface cinnamon-buff with indistinct sepia blotches; a median frontal line of sepia;

greyish buff superciliary streaks; sepia line from bill through eye; under surface pinkish buff suffused with cinnamon on the breast. *Colour variety.* An albino from Ohau is thus described by Buller: White, tinged with brown on the head, back and wings; wing coverts partially brown; lining of wings, axillaries and upper tail coverts barred with pale brown; bill whitish; legs black. An albino with a few brown feathers was obtained in Auckland Harbour and a pure white specimen at Tairua.

Eggs. Clutch four, pyriform; greenish brown to brown, with rather scattered spots and blotches of olive-grey to brownish olive, 50.5 x 38.2, 54.8 x 36.1, 60.5 x 37.7 mm.

Status. The Bar-tailed Godwit comprises two subspecies. The European subspecies, *L. l. lapponica,* is smaller than the other and has the rump white, the axillaries with narrow bars of brown and the under wing coverts pure white or sometimes with small brown spots. It breeds in northern Europe and Asia as far east as the Khatangse River, migrating to Africa and Arabia. The Eastern Bar-tailed Godwit, *L. l. baueri,* breeds in northern Siberia from the Lena eastwards and migrates to Australia, Tasmania and New Zealand. This subspecies is larger than the European subspecies and has the lower back and rump more closely spotted and the axillaries and breast feathers with a greater proportion of brown. As a species the Bar-tailed Godwit is distinguished from both the Black-tailed Godwit and the Hudsonian Godwit by the barred tail and the absence of a white bar on the wing.

Distribution. Kermadec Islands, irregular visitor on spring migration. Flocks on the autumn migration (March) have been seen near the Three Kings. In the North Island, in the summer months, large numbers, up to ten thousand at a time, are to be seen in the harbours of Parengarenga, Kaipara and Manukau, and in the Firth of Thames. Lesser numbers visit Tauranga and Ohiwa Harbours in the Bay of Plenty and fewer still along the remainder of the coast. In the South Island large numbers have been recorded from the Nelson boulder bank and from Farewell Spit. Elsewhere, as at Wairau River mouth, Okarito, Taramakau, Lake Ellesmere and Waikouaiti, the birds occur in smaller numbers. Godwits have been observed in Otago Harbour and at Invercargill. Fair numbers visit Paterson Inlet in Stewart Island. Outlying islands visited irregularly are Great Barrier, Kapiti and the Chatham Islands. Stragglers have been recorded at Mokohinau and at Auckland, Campbell and Macquarie Islands.

Breeds in north-eastern Siberia and Alaska and, during the northern winter, migrates through Japan, China, the Philippines, and the Malay Archipelago to its winter quarters in New Guinea, Australia, Tasmania and New Zealand. Small numbers pass by way of Samoa, Fiji, Lord Howe and Norfolk Islands. Recently Stidolph has assembled evidence indicating that the main migration route of the Eastern Bar-tailed Godwit to and from New Zealand is further to the east than has hitherto been believed. He agrees with P. C. Bull that the route lies over the south-west Pacific well to the eastward of the Solomon Islands.

Migration. The Eastern Bar-tailed Godwit arrives in Alaska by way of the Aleutian Islands in May and early June, and leaves on its southward migration in August.

Making observations at Parenga in the north of New Zealand over a period of 32 years, A. H. Watt says: "Godwit flocks arrive at Parengarenga Harbour in September, generally after the second week, and remain in approximately the same numbers throughout the summer. No increase has been noted before departure, which generally takes place during the last week in February and first week in March. At this time, however, there is much activity in the flocks, large bodies of the birds circling together and performing side-slipping flights, as if there had been an increase in coherence within the flock. The flocks finally disappear, but without assembling at any particular place."

In the same locality Turbott describes the departure of flocks of Godwits in these words. "An experience on 26/3/51 on the flats off Te Pua peninsula is particularly interesting as it seems probable that a departure was actually seen. Two compact flocks each containing 150-200 godwits, appeared near the flats, at low tide, calling strongly as they flew past. Their flight was followed as they rose above the peninsula, but instead of dropping to the northern channel, they circled widely ascending to some height. The two flocks were followed in the field glasses, rising in a spiral path towards the north, where they were finally lost to sight. They included a proportion of bright red-plumaged birds. It seems probable that this procedure, which has been witnessed in previous years by A.H.W., is that followed as the urge to depart reaches its peak; and would take place whether the birds were on feeding grounds or congregated at high tide."

In New Zealand Godwits are in their winter plumage; before the autumn migration a fair proportion assume more or less of the rufous brown of the summer garb.

Habitat. During its sojourn in New Zealand, the Godwit frequents the inlets, estuaries and lagoons along the coast, where it feeds on the intertidal mud and sand flats and lagoon shores. It has once been recorded as far inland as Lake Rotorua. When the tide covers their feeding grounds, the birds move to some locality, generally towards the sea coast where they rest until the flats are clear again. Thus the Godwits regularly collect in certain places, named puta by the Maoris, at high tide. Also, during the prevalence of storms, the Godwit seeks shelter inland or behind the sand dunes and to such places also the term puta was applied.

At Parengarenga Harbour Watt states: "During the summer there is a constant routine with the tides. As the tide rises within the harbour, flocks, generally of some considerable size, pass swiftly towards the east, where the birds congregate on the ocean beaches to north and south of the Heads. One flock observed here at high tide numbered at least 10,000; knots and other small waders were probably included in considerable numbers. As soon as the tide begins to fall the birds return to the harbour in smaller flocks of about 30. The piping call is frequently heard during both inward and

Manukau Harbour *D. A. Urquhart*

EASTERN BAR-TAILED GODWITS

outward flights." Similar daily tidal movements of Godwits were observed by myself in the most southern locality regularly visited by Godwits, namely, Paterson Inlet in Stewart Island. Here large flocks frequent the intertidal flats at the head of Paterson Inlet, and when the tide covers their feeding grounds they move to the ocean beach at the Old Neck. On several occasions I observed flocks of Godwits flying low over the water to the south of Ulva.

Many Godwits stay in New Zealand over the winter. From 600 to 1000 have been recorded as wintering in Manukau Harbour, and many have been reported as wintering in Parengarenga Harbour.

Food. The Godwit feeds on small crustacea, worms, mollusca and vegetable matter. When the tide is out it scatters over the intertidal flats especially those covered with Zostera where there is an abundance of animal life. Much food is picked up on the surface but the mud is also probed often to the full length of the bill, evidently for marine worms which live at a little depth. In Alaska, the food of the Godwit is almost entirely insects and their larvae which abound in the fresh-water pools on the tundra.

Nesting. In Alaska, according to Brandt, the Pacific Godwit prefers for its nesting sites the ridges on the tundra and nests even occur on the lower mountain slopes. The nest is well concealed between clumps of bunch grass. It is merely a depression in the moss or lichen lined with fragments of the surrounding lichen. Occasionally a nest is more substantially constructed of grass. The female incubates the eggs while the male keeps guard and meets any intruder at a considerable distance, so that it is very difficult to locate the nests. This is no doubt of advantage in a region frequented by jaegers.

The eggs are laid mainly during the latter part of May and beginning of June. The young are flying by the middle of July and then appear to wander northward before beginning their southward migration in August.

Maori. The flesh of the Godwit was an important article of food for the Maori. The birds were cooked unopened and the whole bird, including the contents of the stomach, eaten. They were also potted for future use.

One method adopted by the Maori for catching Godwits is described by Buller. Flax snares are spread horizontally on manuka stakes twelve to fifteen feet high so as to cover the area of the birds' resting place. The birds on assembling in the evening fly low and take up their positions on the resting ground to await the fall of the tide. After dark the Maoris spring out from cover with lighted torches and the birds rise vertically in confusion, large numbers becoming caught or entangled in the nooses.

Another method was simply to rush into the midst of the birds with torches, clubs and nets and kill or catch the birds before they had time to get away. Sometimes flax nooses were tied together on ropes stretched about a foot from the ground, at other times the nooses were arranged on high poles placed in line across the regular track of flight of the Godwits. By these and other similar methods the Maori was well supplied with Godwits during the time these birds stayed in New Zealand.

References.—Linne, Syst. Nat., 10th ed., 147, 1758 (*Scolopax lapponica,* Lapland). Naumann, Vog. Deut., 8, 429, 1836 (*Limosa baueri,* Victoria). Gray, Zool., Erebus and Terror, Birds, 13, 1845 (*L. lapponica* var. *Novae zealandiae*). Buller Birds N.Z., 198, 1872; 2nd ed., 2, 40, col. pl., 1888. Bent, Bull, U.S. Nat. Mus., 142, 289, 1927. Watt, N.Z. Bird Notes, 2, 117, 1947. Turbott, Notornis, 4, 128, 1951. Stidolph, Notornis, 6. 31. 1954.

Hudsonian Godwit

Limosa haemastica

A regular migrant throughout the entire length of the American continents, this species evidently gets caught up occasionally in the migratory stream which passes from Alaska down the Western Pacific and so reaches New Zealand. It is one of the species added to the fauna of this country by E. F. Stead, who shot the first specimen at Lake Ellesmere in 1902. It was next seen by Stead in the same locality in 1937, and since then there have been at least twelve other records of its presence in New Zealand. It was first noticed in the North Island by Sibson and Ridland at Port Waikato in 1940.

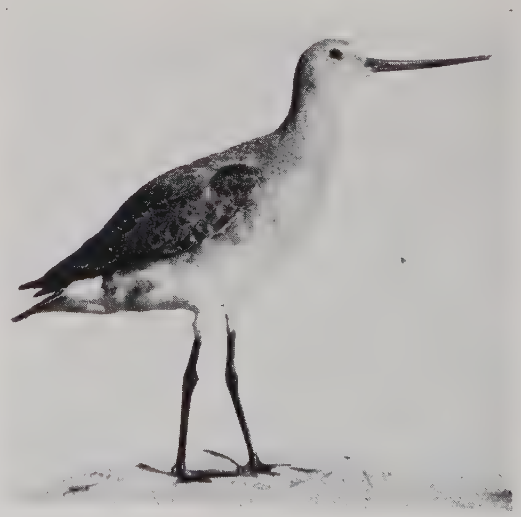
Adult Male—Summer plumage. Head ashy brown, slightly washed with rufous and streaked with blackish brown; upper surface black, mottled with white edges and rufous spots and notches to the feathers; lower back and rump greyish brown; anterior upper tail coverts white, posterior ones black; tail black, tipped with white and with a white base. Wing coverts brown, the greater series tipped with white; primary coverts black, the inner ones tipped with white; quills blackish. Eyebrows whitish; lores dusky; sides of face and neck and chin whitish with a rufescent tinge, and with fine streaks of brown; rest of under surface deep chestnut streaked on throat and foreneck and barred elsewhere with dusky blackish; under tail coverts barred rufous and black and tipped with white. Bill greyish yellow, culmen and tip dark brown. Iris brown. Feet greyish blue. Bill 67-92, wing 196-222, tail 72-82, tarsus 54-62, mid toe 31-35 mm. *Adult Female—Summer plumage.* Similar to male but under parts barred with white, dusky and chestnut; flank feathers chestnut with blackish bars and white tips; breast feathers, base white, barred with dusky, outer half chestnut tipped with white. *Adult in winter.* Crown brown; a dark brown band from the bill through the eye bordered by a pale whitish band above and below; upper surface, neck and breast brownish grey with light mottling on wings and some of the coverts tipped with light grey or white. Tail black with base and tip white. Under surface behind the breast whitish or pale buffy. *Immature.* Similar to adult in winter but feathers of mantle, and scapulars edged with cinnamon and tail tipped with buffy white.

Eggs. Clutch four, pyriform, olive-buff to brownish olive, sparingly marked with buffy olive to sepia; spots mostly at the larger end, 51 x 35, 56 x 41.2, 60.6 x 39.6 mm. Arctic Canada.

Status. A well marked species agreeing with the Bar-tailed Godwit (*Limosa lapponica baueri*) in its upturned bill and short, nonpectinate claws on all the toes. It differs from the European Black-tailed Godwit (*Limosa limosa*) in the under surface being a rich chestnut instead of pink cinnamon and the colour extending to the lower abdomen and, partly, the under tail coverts. The head, neck and upper breast differ in being striped and spotted instead of plain. The Hudsonian Godwit is smaller than the European Black-tailed Godwit and the whitish alar bar is not nearly so conspicuous.

Distribution. Fourteen occurrences. Mangawai. Ruakaka. Manukau Harbour (3). Port Waikato. Firth of Thames. Lake Ellesmere (7).

Breeding in Arctic America from Alaska to Hudson Bay and migrating southwards in the northern winter as far as Chile, Argentina and the Falkland Islands. The species is said to be now nearly extinct as the result of shooting in its winter quarters. The Hudsonian Godwit arrives in the Arctic coastal region during the month of May and leaves again in August, travelling to the Atlantic



Lake Ellesmere *L. A. Shand*

HUDSONIAN GODWIT

coast, and from Nova Scotia to Brazil over the Atlantic. It passes the southern summer in the extreme south of South America, some birds remaining in Patagonia throughout the year. The return journey is by way of the central United States and Canada. The few that reach New Zealand probably travel with the Alaskan and Eastern Asiatic migrants, through the Malay Archipelago. Occasional visitor to Australia.

Habits. The Hudsonian Godwit, while in New Zealand, is found on mud and sand flats and sand banks in harbours associating with Stilts and Bar-tailed Godwits. Birds have been seen during all months from October to April and in July. One wintered in Manukau Harbour in 1946.

Practically nothing is known of the breeding habits of this species. The few nests found in Arctic Canada have been described as made of a few leaves in small holes scooped in the ground. The eggs obtained have all been collected in June.

References.—Linne Syst. Nat., 10th ed., 147, 1758 (*Scolopax haemastica*, Hudson Bay). Latham, Ind. Orn., 2, 720, 1790 (*S. hudsonica*). Bent, Bull. U.S. Nat. Mus., 142, 295, 1927. Mathews, Suppl. Birds Norf. Lord Howe Is., 113, col. pl., 1936. Sibson, Emu, 43, 136, 1943; N.Z. Bird Notes, 2, 35, 1947; 3, 199, 1950.

GENUS XENUS

Bill long, upturned, much wider at base than at tip. Short webs to both outer and inner toes. Tarsus scutellate in front and behind. Hind toe small.

A single species, related to Tringa but distinguished by the upturned bill, breeding in the northern Palaearctic Region and wintering as far south as South Africa and Tasmania.

References.—Kaup, Skizz. Entw.-Gesch. Eur. Thiern., 115, 1829 (*Xenus*, type *Scolopax cinerea* Guld.).

Terek Sandpiper

Xenus cinereus

The Terek Sandpiper was added to the avifauna of New Zealand by H. R. McKenzie who saw an example at Miranda on the Firth of Thames on November 22nd, 1951. It was later seen by several other ornithologists. Two birds spent the winter of 1952 in the same locality.

Adult. Forehead white, more or less streaked with ashy brown; upper surface and sides of breast ashy brown, the feathers with white edges; some scapulars and feather of the mantle with blackish brown centres; wing coverts sepia tipped white; primaries and their coverts blackish brown; secondaries sepia broadly tipped and bordered with white, flanks white. Stripe above eye, lores, lower throat and sides of neck white streaked with ashy brown; breast white faintly streaked or spotted with sepia; remainder of under surface including axillaries white. Bill black, base pale orange. Iris dark brown. Feet orange. Bill 43-52, wing 126-140, tail 47-56, tarsus 25-28 mm. When the bird is in its *winter* plumage the black centres to the feathers of the upper surface are not present. The *immature* is similar to the adult except the edgings of the feathers of the upper surface including the tail which are light buff. The *nestling* has the bill slightly upcurved; upper surface light buff with black bases and tips to the down; blackish brown bands from bill through eye to crown, median band from bill to back of crown and from nape to uropygial tuft; sides of face and neck, chin and throat light buff or white; remainder of under surface white.

Eggs. Clutch four, sometimes three or five, subpyriform, olive to stone buff spotted and blotched mostly at the larger end with sepia and ashy. 36.7 x 24.4, 38 x 28 mm.

Distribution. Firth of Thames (Miranda, Waitakaruru), sight records.

Breeds in north Europe, north Siberia and central Asia. Migrates in the northern winter to South Africa, India, Malay Archipelago, New Guinea, Australia and Tasmania.

Habits. When first seen at Miranda the bird was flying with Wrybills. "Its actions on the ground," writes McKenzie, "were quick, very much like Sanderling, as it fed on the mud among scattered Wrybill and Banded Dotterell. It appeared to feed by quick dabs and was seen to take a small crab which it apparently swallowed after shaking off the legs."

The stations in which the Terek Sandpiper is found in the Arctic regions of Europe and Asia are damp grasslands and willow scrub. It nests in the vicinity of rivers and lakes in open ground a little way from the water's edge. The nest is a shallow depression in the ground lined with a little drift material. In north Russia the breeding season extends from the end of May to the middle of June. So far only the males have been recorded as incubating. In the breeding areas the only food known to be eaten by the Terek Sandpiper is aquatic insects. On migration beetles and crustacea are known to be part of the food of this sandpiper.

References.—Guldenstaedt, Novi. Comm. Sci. Petropol., 19, 473, 1774 (*Scolopax cinerea,* Caspian Sea). McKenzie, Notornis, 4, 212, 1952.

Genus Tringa

Bill nearly as long as tarsus, slightly upcurved, nasal groove less than half length of bill. Tarsus nearly twice as long as middle toe without claw, scutellate in front and behind. A web at base of outer and middle toes. Hind toe very small, elevated.

About ten species ranging over the whole world.

Key to New Zealand Species

Lower back and rump white. Feet olive green. Tarsus much longer than mid toe .... *T. nebularia*
Lower back and rump grey. Feet yellow. Tarsus not much longer than mid toe.
  Nasal groove more than half-culmen. Tarsi scutellate in front and behind. Under surface barred (summer) .... *T. incanus*
  Nasal groove about half culmen. Tarsi scutellate in front reticulate behind. Abdomen white .... *T. brevipes*

References.—Linnaeus, Syst. Nat., ed. 10, 148, 1758 (*Tringa,* type *T. ochropus* L.). Koch, Syst. Baier Zool., 304, 1816 (*Glottis,* type *Scolopax nebularia* Gunn.). Baird, Rep. Exp. Surv. Pac. Ocean, 9, 734, 1858 (*Heteroscelus,* type *Totanus brevipes* Viell.).

Greenshank

Tringa nebularia

One specimen only of this wide ranging species has been obtained in New Zealand. In 1874, Hutton purchased an example in the Dunedin market that had been shot somewhere in Otago. A second bird was seen by R. H. D. Stidolph at Awapuni Lagoon, near Gisborne, on November 17, 1952.

Adult—Summer plumage. Top of head and hind neck greyish white, broadly streaked with dark brown; upper back and scapulars blackish with grey edges to the feathers; wing coverts dark brown, the larger ones edged with grey; primaries dark brown; secondaries greyish brown, long inner ones dark brown with the margins barred grey and black; lower back, rump and upper tail coverts white; tail white, barred with greyish brown. Sides of head, foreneck and sides of neck white streaked with brown; breast white blotched with brown; chin, and under surface behind breast white. Bill slate. Iris brown. Feet pale olive green. Bill 50-59, wing 184-200, tail 68-80, tarsus 55-63, mid toe 31-35 mm. *Adult—Winter plumage.* Similar but greyer above and uniform white below. *Immature.* Similar to adult in winter but the upper surface with the margins of the feathers regularly edged with white. *Nestling.* Upper surface brownish grey mottled with blackish brown; frontal and loral streaks of dark brown; under surface white.

Eggs. Clutch four, pyriform, pale stone colour to buff, marked all over with purplish to dark red blotches. 45.8 x 35.4, 50.4 x 32.4, 59.8 x 37.7 (av. 51.4 x 34.8) mm. Scotland.

Distribution. Otago. Gisborne, sight record.

Breeding in Northern Europe and Asia, and migrating thence to South Africa, India, Malay Archipelago, Australia and Tasmania. Accidental in North and South America. Arrives in Northern Europe in April leaving again mostly in September and

October. It winters from the Mediterranean, South Asia and China, southwards.

Habits. In the British Isles, the Greenshank breeds on moorlands in Scotland generally near small pools. In the breeding season it sings on the wing as well as on trees or on the ground, its notes being very varied. The nest is placed against a rock and is merely a shallow depression lined with a few stalks of heather and bay myrtle or bilberry leaves. The eggs are laid in May. The Greenshank sometimes nests in country intersected by belts of forest and then it perches on the trees using them as look-out posts. It feeds on insects, crustacea, mollusca, worms and tadpoles. In autumn and winter it feeds along the coast.

References.—Gunnerus, Knud. Leem. Lapp. Beschr., 251, 1767 (*Scolopax nebularia,* Norway). Witherby *et al,* Handbk Br. Birds, 4, 335, 1948.

Wandering Tattler

Tringa incanus

The Wandering Tattler was discovered during Cook's second voyage at Tahiti and other islands of the South Pacific, and though its winter domain includes nearly all the islands of the Pacific, it has only on three occasions been obtained or observed within the New Zealand region. A pair was shot on Portland Island, Hawke's Bay, in 1883, by C. H. Robson, and a specimen in summer plumage was shot at Raoul Island by W. S. Bell in 1913. The third occurrence was a bird observed by H. R. McKenzie at Kawakawa Bay, near Clevedon, in 1948.

Adult—Summer plumage. Nasal depressions two-thirds the length of the bill. Upper surface olive-grey; some of the wing coverts dark brown edged with white; quills dark brown; an indistinct white line from bill over eye. Sides of face greyish white streaked with brown; chin and throat white, minutely spotted with brown; rest of under surface white, the foreneck streaked and the remainder barred with dusky slate colour. Bill greenish horn, yellowish at base. Iris dark brown. Feet yellow. Bill 34-42, wing 161-180, tail 71-80, tarsus 32-37, mid toe 29-34 mm. *Adult—Winter plumage.* Upper parts slightly paler than in summer, under surface without streaks or bars, the white shaded with slaty grey on foreneck, chest and sides. *Immature.* Similar to adult in winter but scapulars, inner secondaries and upper tail coverts spotted with white along edges; feathers of sides edged with white. *Nestling.* Upper surface pale grey indistinctly barred with blackish and with streaks and spots on the head; under surface white, greyish on breast.

Eggs. Clutch four, pyriform, greenish glaucous irregularly spotted and blotched chiefly at larger end with drab to dark brown, 44.5 x 31.4, 43.3 x 32.7 mm. Alaska.

Status. Close to the Asiatic species, *brevipes.* The Wandering Tattler, however, differs from *T. brevipes* in the longer nasal grooves, scutellated tarsi both in front and behind, and, in the summer plumage, completely barred under surface and uniformly coloured upper tail coverts. In winter plumage the two species are much alike.

Distribution. Raoul Island, Kermadec group; one occurrence. Kawakawa Bay, sight record. Portland Island, Hawke's Bay, one occurrence, pair.

Breeding in Alaska and probably Eastern Siberia. Wintering throughout the Pacific from the Philippines, Hawaiian Islands and California in the north to Australia and the Tuamotu Archipelago in the south. Accidental in Lord Howe Island.

Habits. H. R. McKenzie, who discovered the Wandering Tattler at Kawakawa Bay, writes: "The haunt of the tattler at Clevedon is a rocky point in the centre of a wide shallow bay. It sometimes feeds on the sandy mud but more often among the rounded dark-grey stones of some ridged shingle spits at the point and a round shingle bed close by. Among these stones it is practically invisible at twenty yards when it is not moving."

The nest of the Wandering Tattler has been found on two occasions only. The first was discovered by Sir F. Lambert in 1912, about 25 miles south of the Arctic Circle, and near the Alaska-Canadian Boundary line. It consisted of a hollow in the gravel and contained four eggs which hatched on July 9th. The second nest was found on July 1st, 1923, by O. J. Murie on the Savage River, Alaska, at an elevation of 4,000 feet and contained four eggs which were collected. This nest was, like the first, on a gravel bar and was made of roots and twigs lined with small bits of twigs and dry leaves.

The Wandering Tattler frequents rocky shores following the waves and dodging the breakers while it seeks for its food among the seaweed. Its food consists of crustacea, worms, molluscs and insects.

References.—Gmelin, Syst. Nat., 658, 1789 (*Scolopax incana,* Eimes and Palmerston Is.). Buller, Birds N.Z., 2nd ed., 2, 38, 1888. Bent, Bull. U.S. Nat. Mus., 146, 41, 1929. Serventy, Emu, 43, 274, 1944. McKenzie, N.Z. Bird Notes, 3, 178, 1949.

Grey-rumped Tattler

Tringa brevipes

Sight records by E. G. Turbott in Parengarenga Harbour in February, 1950, and at later dates by the same and other observers, constitute the evidence for the presence of this species in New Zealand. Confirmation of the identification was got by hearing the characteristic cry of the species.

Adult—Summer plumage. Nasal depressions about half the length of the bill. Upper surface slate grey, the feathers narrowly margined with white, more broadly on the greater wing and upper tail coverts; primary coverts dark brown tipped white; primaries dark brown; secondaries grey fringed with white; forehead, line over eye, throat and sides of face white minutely spotted and streaked with grey; foreneck, breast and sides of body barred white and grey; abdomen and under tail coverts white, the latter barred with grey at the tips. Bill black, base of lower mandible brown. Iris dark brown. Feet yellow. Bill 34-40, wing 150-174, tail 67, tarsus 27-35, mid toe 28.5-32.5 mm. *Winter plumage.* Uniform slate grey above, white barring on rump at some stages; uniform pale grey on foreneck, breast and sides of body. *Immature.* Similar to winter but feathers of upper surface dappled with white; lower flanks more or less barred with white.

Status. Closely allied to the Wandering Tattler but treated as a distinct species in the British Checklist. The nasal depression is shorter than in the Wandering Tattler and the abdomen is white and unbarred.

Distribution. Parengarenga Harbour. Sight record, several birds. Breeding in eastern Siberia, migrating to East Indies, western Pacific, eastern Indian Ocean and Australia.

Habits. Turbott records the Grey-rumped Tattler as associating with large flocks of other species of waders in Parengarenga Harbour. The call, which is characteristic of the species, is described by Turbott as "generally of only two distinct notes which might be described as 'whew-rit' or 'whewew-reet' the final syllable being emphasised and higher in pitch."

References.—Vieillot, Nouv. Dict. Hist. Nat., ed. 6, 410, 1816 (*Totanus brevipes,* Timor). Serventy, Emu, 43, 276, 1944. Turbott, Notornis, 4, 130, 1951.

GENUS NUMENIUS

Bill variable in length, equal to or much longer than tarsus, arched, nasal grooves long. Tarsus scutellate in front; usually reticulate behind. Toes connected by web at base; hind toe strong.

Distinctive features of this genus are the long, arched bill and brown-spotted coloration with dark patch on top of head. These characters serve to separate it easily from all other members of the family, Scolopacidae. Eight species breeding in the Palaearctic region and migrating as far as the south temperate zone in the northern winter.

Key to New Zealand Species

Tarsus scutellate in front reticulate behind.
  No median pale stripe on crown .... *N. madagascariensis*
  A median pale stripe on crown ...*N. phaeopus*
Tarsus scutellate in front and behind .... *N. minutus*

References.—Brisson, Orn., 5, 311, 1760 (*Numenius,* type *Scolopax arquata* L.). Sharpe, Cat. Birds Br. Mus., 24, 371, 1896 (*Mesoscolopax,* type *Numenius minutus* Gould).

Eastern Curlew

Numenius madagascariensis

The inappropriate and misleading name *madagascariensis* was given by Linnaeus probably because his specimen was wrongly labelled. The rules governing the names of species admit of no exceptions so *madagascariensis* must be used for a bird that inhabits eastern Asia. During the past eighty years the Eastern Curlew has been recorded from at least fifteen localities in New Zealand, although the regular migration track of the species is between Eastern Siberia and Australia. The first specimen to be obtained in New Zealand was one shot by S. C. Liardet, near the Wairau River mouth, in 1874. Two years later one was taken at Kaiapoi, in April, and another at the Ashley River mouth at the end of June.

Adult. Top of head and hind neck dark brown streaked with whitish; upper surface of body and wing coverts dark brown mottled with buff margins and notches to the feathers; primaries dark brown with the inner webs variegated with buff; secondaries brown variegated with buff margins. Upper tail coverts and tail barred buff and dark brown. Sides of face and foreneck white, streaked with brown; chin and throat white; rest of under surface white, tinged with buff and with brown spindle-shaped marks, except on the abdomen and thighs. Bill dark brown, flesh-white at base of lower mandible. Iris brown. Feet bluish grey. Bill 185-200, wing 295-315, tail 120-127, tarsus 90-95, mid toe 53 mm. *Immature* similar to the adult but the light markings on the upper surface more rufous.

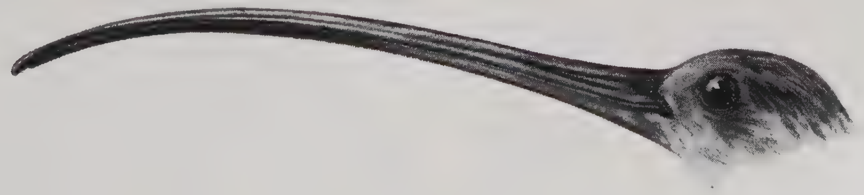
Status. The Eastern Curlew is the largest species of the genus *Numenius.* It is distinguished from the Western or European Curlew (*N. arquatus*) by its larger size and by the rump and upper tail coverts being barred dark brown and buff. Curlews have no central light band on the crown as have Whimbrels.

Distribution. Occasional visitor. Parengarenga Harbour, Little Barrier Island, Muriwai beach, Manukau Harbour, Firth of Thames, Ohiwa Harbour, Te Araroa, Waitotara River mouth, Castlecliff, Wellington Heads, Wairau River mouth, Ashley River mouth, Kaiapoi, Waimakariri River mouth, Lake Ellesmere, Saltwater Creek, Awarua Bay.

Breeding in Eastern Siberia as far west as Southern Baikal and as far south as 57° North latitude, and wintering in China, Japan, Philippine Islands, eastern Malay Archipelago, New Guinea, Australia and Tasmania.

Habits. In New Zealand the Curlew has on several occasions been seen to associate with Godwits. It has been observed on mud flats in harbours and on ocean beaches generally near the mouths of rivers. It has been seen during most months of the year from January to September and has been reported to have stayed over the winter in Parengarenga Harbour and at Saltwater Creek.

The nesting season of the Curlew in



Lily A. Daff

EASTERN CURLEW

Eastern Siberia is June. It arrives in Australia and Tasmania from September to December and leaves again in May and June, but many stay over in Australia for the winter. It is especially abundant on the east coast of Australia where up to a thousand birds have been seen at one time. It feeds on mud flats in estuaries and salt marshes.

References.—Linnaeus, Syst. Nat., ed. 12, 1, 242, 176 (*Scolopax madagascariensis,* "Madagascar," error for Philippines). Vieillot, Nouv. Dict. Hist. Nat., 8, 306, 1917 (*N. cyanopus,* New South Wales). Buller, Birds N.Z., 2nd ed., 2, 45, 1888.

Eastern Whimbrel

Numenius phaeopus variegatus

The Eastern Whimbrel is a fairly regular visitor to New Zealand. In the South Island it was first taken at New Brighton in June, 1879. In the North Island a bird was seen by R. B. Sibson at the mouth of the Piako River in 1942. One was shot by myself at Raoul Island in the Kermadec group in September, 1908.

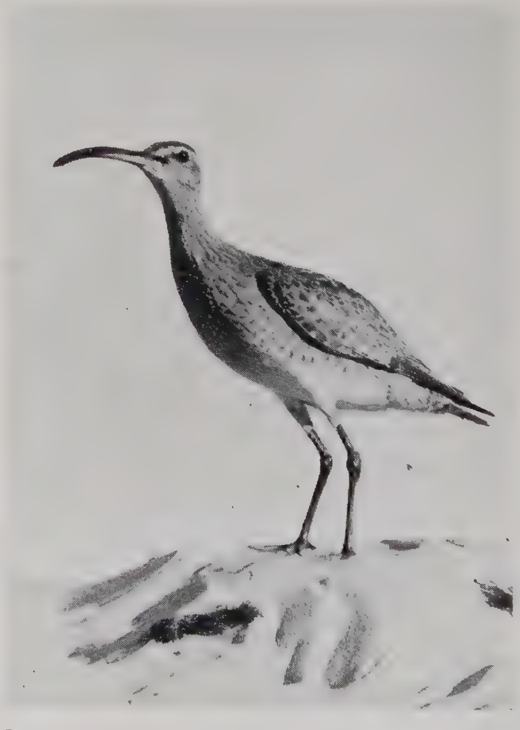
Adult. Crown dark brown with a median streak of whitish; hind neck dark brown streaked with buff; upper back, scapulars and wing coverts dark brown, the feathers with paler margins; lower back white, the feathers with brown centres; rump and upper tail coverts white heavily barred with brown; tail greyish brown barred with dark brown; primaries dark brown, the inner webs variegated with white; secondaries dark brown variegated with white margins and notches. A white line from bill over each eye; lores and side of face, sides of neck, foreneck and breast whitish streaked with brown; chin and throat white; abdomen white; flanks, axillaries and under tail coverts white, barred with brown. Bill dark with orange base to mandible. Feet bluish grey. Bill 72-80, wing 222-225, tail 90-95, tarsus 54-62, mid toe 37 mm.

Status. The Eastern Whimbrel is one of the three subspecies comprising the species *phaeopus.* It differs from the typical subspecies in being slightly smaller, the rump more heavily spotted and barred, the axillaries with broader and more numerous brown bars and the under wing coverts more plentifully streaked and barred.

Distribution. Raoul Island, Kermadec group. Parengarenga Harbour, Pakiri, Manukau Harbour, Kawakawa Bay (near Clevedon), Waitakaruru, Miranda and mouth of Piako River in Firth of Thames, Ohiwa Harbour, Gisborne, Ohau River mouth, Petone, Waimakariri River mouth, New Brighton, Lake Ellesmere, Westport, Greymouth, New River Estuary.

Breeds in eastern Siberia as far west as the Lena and Lake Baikal; winters in Malay Archipelago, New Guinea, Western Pacific islands, Australia and Tasmania. Visitor to Lord Howe and Norfolk Islands.

Habits. The Eastern Whimbrel has been seen in New Zealand during every month of the year. It is recorded as wintering in the Firth of Thames from 1946 to 1949. It favours mud flats and sandy beaches in har-



Lake Ellesmere *L. A. Shand*

EASTERN WHIMBREL

bours, and ocean beaches at the mouths of rivers. On several occasions it has been seen with flocks of godwits.

I have not come across any account of the nesting of the Eastern Whimbrel. It arrives in Australia, mainly along the east coast, in October and leaves again in March.

References.—Linne, Syst. Nat., ed. X, 146, 1758 (*Scolopax Phaeopus,* Europe). Scopoli, Del Flor. Faun. Insubr., 2, 92, 1786 (*Tantalus variegatus,* Luzon). McKenzie., N.Z. Bird Notes, 3, 56, 1948. Fleming, Notornis, 4, 2, 1950

Hudsonian Whimbrel

Numenius phaeopus hudsonicus

The Hudsonian Whimbrel is a very rare straggler to New Zealand, there being only two recorded occurrences. The first was in 1874 when S. C. Liardet shot a bird of this species at the mouth of the Wairau River. The label on the specimen in the Dominion Museum states that it was purchased on July 25th, 1874. It is likely therefore that the bird was shot close to this date. The second occurrence is a sight record, a bird being seen in Ohiwa Harbour, Bay of Plenty, by H. R. McKenzie in June 1949 and again the following December.

Adult. Crown dark brown with a narrow central buff stripe; hind neck pale buff streaked with dark brown; scapulars, back, rump and upper tail coverts dark brown, the feathers spotted along the margins with buff; wing coverts and secondaries similar but paler; primaries dark brown, spotted on outer webs with buff; tail greyish brown narrowly barred with dark brown. Superciliary stripe pale buff narrowly streaked with dark brown; lores dark brown; chin and upper throat buffy white; sides of head and neck, chest and upper breast pale buff streaked with dark brown; lower breast, abdomen and anterior lower tail coverts pale buff; flanks and posterior under tail coverts pale buff barred or spotted with greyish brown; axillaries and under wing coverts vinaceous buff barred with greyish brown. Bill blackish, basal part of mandible flesh coloured. Iris brown. Feet greyish. Bill 77-95, wing 232-257 (240-267 in female), tail 88-102, tarsus 52-61, mid toe 33-38 mm. The *immature* is like the adult but has a shorter bill, the markings on the neck and breast are finer and closer and the under parts are more buffy.

Eggs. Clutch four, ovate pyriform, bluish green to olive buff to light olive green, marked with spots and blotches of warm brown to pale lavender, mostly at the larger end. 55 x 37.2, 59.2 x 43.2, 61.9 x 41.7 mm.

Status. The Hudsonian Whimbrel is distinguished from the other subspecies of *Numenius phaeopus* by the lower back and rump being concolour with the upper back, the under parts more buffy, and the axillaries and under wing coverts vinaceous buff.

Distribution. Wairau River mouth. Ohiwa Harbour, sight record.

Breeds in Arctic North America from Alaska to Hudson Bay; winters from southern California to Chile, the Galapagos Islands and the mouths of the Amazons.

Habits. The Hudsonian Whimbrel leaves its winter quarters on the Pacific coast of South America in March. One stream travels along the Pacific coast of South America to Alaska; another stream, presumably including the birds from Brazil, follows the Atlantic coast from Florida to the Hudson Bay region. The southward journey begins early in July, the vanguard arriving in Chile in mid-August.

According to J. Grinnell the Hudsonian Whimbrel arrives in northern Alaska in May. It breeds on the open tundra, often where it alternates with forest and lakes. The nest is a depression on the top of a low hummock of moss or grass in wet places where the clumps of moss or grass are often surrounded by water.

References.—Latham, Index. Orn. 2, 712, 1790 (*Numenius hudsonicus,* Hudson Bay). Ridgway, Bull. U.S. Nat. Mus., 50, pt. 8, 402, 1919. Bent. Bull. U.S. Nat. Mus., 146, 113, 1929. McKenzie, Notornis, 4, 18, 1950.

Little Whimbrel

Numenius minutus

The Little Whimbrel has been taken in New Zealand on six occasions, all the specimens being obtained at Lake Ellesmere. Two were seen by E. F. Stead in June, 1900, and one of them was shot. The other five were obtained betwen 1921 and 1927.

Adult. Crown dark brown with a median streak of buff; hind neck dark brown streaked with buff; back, scapulars and wing coverts dark brown mottled with buffy edgings and notches to the feathers; lower back rump and upper tail coverts dark brown mottled with ashy white, some of the upper tail coverts regularly barred; tail greyish brown, barred with dark brown; primaries dark brown, the outer one barred; secondaries pale brown with buff edges. Line over eye buffy white; lores and sides of face buff, speckled with brown; chin and throat white; foreneck and breast buffy white streaked with brown; abdomen and under tail coverts white. Bill blackish brown, the basal half of the mandible flesh colour. Iris dark hazel. Feet pinkish grey. Bill 45, wing 170-180, tail 70-75, tarsus 48-50, mid toe 33 mm. *Immature* similar to adult but with the light markings on the upper surface more rufous. *Nestling* buff above with two brown bands on the crown and down the back; a dark patch behind the eye; tail brown; sides and under surface buffy white.

Eggs. Clutch three, ovate pyriform, olive buff with blotches and spots of brown and grey mainly at the larger end. 54 x 37 mm.

Status. This distinct species is distinguished by its small size, bill shorter than tarsus, uniformly coloured primaries and scutellation on the back of the tarsus.

Distribution. Lake Ellesmere. Six occurrences. Ahuriri Lagoon, sight record.

Breeds in Eastern Siberia between North latitude 59° and 68° and east of the upper Yana and middle Lena; migrates through eastern Asia to the Moluccas, New Guinea and Australia. Straggler to Tasmania.

Habits. The Little Whimbrel is recorded by Berney as arriving in large numbers in Queensland in September and October and leaving for the north in March and early April. In the spring it is often seen in small parties but in the autumn there are large flocks often of several thousands. The New Zealand specimens were taken from January to June.

According to Tugarinow the breeding range of the Little Whimbrel is the alpine zone of north-east Siberia on the Verchoyansk Range between the Lena and the Yana, and the mountains at the sources of the Khatanga. The nests are depressions in the ground and eggs were found in June.

References.—Gould, Proc. Zool. Soc., 1840, p. 176, 1841 (*Numenius minutus*, New South Wales). Stead, Trans. N.Z. Inst., 54, 492, 1923. Mathews, Suppl. Birds Norf. Lord Howe Is., 61, 1936.

FAMILY PHALAROPODIDAE
PHALAROPES

Bill rather slender, nasal grooves narrow, pointed in front. Tarsus compressed, scutellate in front and behind; toe with a conspicuous lateral membrance, sometimes developed into broad, scalloped lobes.

This family is closely allied to Scolopacidae, differing chiefly in the lobed toes. The three species may be included in a single genus.

The Phalaropes are sea-going birds, their adaptations to an aquatic life being the partially webbed feet, compressed tarsi and thick plumage on the under surface.

GENUS PHALAROPUS ....

Characters of the Family

Recent authors have united *Phalaropus* and *Lobipes*, notwithstanding the differences in the shape of the bill and the webbing of the toes.

Key to New Zealand Species

Bill broad; lateral membrance of toes broad, scalloped	*P fulicarius*
Bill slender; lateral membrance of toes, narrow, slightly scalloped	*P. lobatus*

Reference.—Brisson, Orn., 6, 12, 1760 (*Phalaropus*, type *Tringa fulicaria* L.). Cuvier, Reg. Anim., 1, 495, 1817 (*Lobipes*, type *Tringa lobata* L.).

Grey Phalarope
Phalaropus fulicarius

Of this nearly cosmopolitan species only three specimens have been obtained in New Zealand. The first was shot by Mr. Studholme in June, 1883, on the beach between the Waimate lagoon (Canterbury) and the sea, the second was obtained by L. A. Shand in 1925 at Lake Ellesmere, and the third at Hastings by Mrs. H. Thompson in July, 1934. All were in summer plumage.

Adult Female—Summer plumage. Top of head, chin and narrow line at back of neck blackish grey; back and scapulars buff striped with black; wing coverts dark grey, the greater series broadly tipped with white; primaries blackish grey; secondaries dark greyish, margined with white; rump grey; upper tail coverts chestnut with some black streaks; central tail feathers blackish, rest dark slate. A large white patch on side of face extending backwards to the nape; neck all round, except black line at back, and under surface deep cinnamon; axillaries and under wing coverts white. Bill greyish yellow with black tip. Iris brown. Feet greyish blue. Bill 19-25, wing 120-140, tail 60-70, tarsus 20-22, mid toe 19-21 mm. *Adult Male—Summer plumage.* Similar to the female but smaller and duller in coloration; top of head and hind neck buff, streaked with black like the back. *Adult—Winter plumage.* Head, neck and underparts white; back of head and hind neck blackish slate; a blackish grey patch through the eye; upper surface light bluish grey; wings and tail darker with white bar on wings. *Immature.* Similar to adult in winter but throat and chest tinged with buff and feathers of upper parts margined with buff. *Nestling.* Upper surface brownish buff, darker on the head, mottled and striped with black; under surface buffy white.

Eggs. Clutch four, pyriform, olive-buff, with irregular marks of brown and dark brown, chiefly at the larger end. 31.2 x 22, 33 x 22, 35 x 22.7 mm. New Siberia.

Distribution. Waimate, Lake Ellesmere, Hastings.

Breeds in the Arctic regions, migrating southwards in winter to Chile, Patagonia, South Africa, India and China.

Habits. The Grey Phalarope arrives in Arctic Canada early in June, leaving again mostly in September. The migration routes are usually well out to sea. It breeds on the Arctic tundra, selecting a grassy part in preference to the mossy portions, and often in a fairly wet situation. The nest is scantily lined with grass and the eggs are laid during June and early July. The male bird builds the nest and does most of the incubating.

Except in the breeding season, the Grey Phalarope lives at sea often hundreds of miles from land.

References.—Linne, Syst. Nat., 10th ed., 148, 1758 (*Tringa fulicaria,* Hudson Bay). Haast, Trans. N.Z. Inst., 16, 279, 1884. Buller, Birds N.Z., 2nd ed., 2, 30, 1888. Bent, Bull. U.S. Nat. Mus., 142, 1, 1927. Pleske, Mem. Bost. Soc. Nat. Hist., 6, 280, 1928. Mathews, Suppl. Birds Norf. Lord Howe Is., 120, col. pl., 1936.

Red-necked Phalarope
Phalaropus lobatus

Only two specimens of the Red-necked Phalarope have been obtained in New Zealand. A male in winter plumage was shot at Lake Ellesmere in 1929 by E. F. Stead and a female in summer plumage was obtained at the mouth of the Wanganui River in April, 1935.

Adult Female—Summer plumage. Upper surface blackish slate, the back and scapulars striped with buff; greater wing coverts broadly tipped with white; sides and front of neck and chest cinnamon rufous; chin, throat and rest of under surface white. Bill black. Iris dark brown. Feet bluish grey. Bill 20-24, wing 102-110 (105-116 in female), tail 43-52, tarsus 18-21, mid toe 18-20 mm. *Adult Male—Summer plumage.* Similar to female but smaller and duller in coloration; cinnamon rufous of neck almost confined to the sides; chest mixed white and greyish, tinged with rufous. *Adult—Winter plumage.* Upper parts chiefly grey; feathers on top of head with dusky shafts and whitish margins; black spot in front of eye and dusky patch below eye. Forehead, superciliary line, sides of head and neck, and under surface white, the sides of the chest washed with pale grey. *Immature.* Upper surface brownish black, the feathers edged with buff; middle wing coverts margined with buff or whitish. Forehead, lores, stripe behind eye and under surface white, the chest and sides of body washed with brownish. *Nestling.* Upper surface brownish tawny, mottled and striped with black; top of head mostly black; sides of head, throat and foreneck buff, rest of under surface white.

Eggs. Clutch four, pyriform, pale to dark olive-buff, with sepia to blackish brown spots or blotches all over. 28 x 20.8, 29.2 x 21 mm. Iceland.

Distribution. Lake Ellesmere. Wanganui River estuary.

Breeding in Arctic and North temperate regions and ranging south in winter to Peru, Patagonia, North Africa, northern part of Indian Ocean, New Guinea and South Japan.

Habits. The Red-necked Phalarope arrives in Arctic America in late May by way of both coasts and also inland. It leaves again during August and September, the main migration routes being a good distance off shore. In the Aleutian Islands, Bent described this species as inhabiting the wetter portions of the flat alluvial plains near the mouth of streams and about marshy ponds. The nests were deep hollows lined with a few bits of grass and were placed in little mounds or tussocks in the wet meadows around the borders of ponds or near small streams. The eggs are laid between the middle of May and the middle of July. Incubation takes about three weeks and is performed mostly by the male.

The Red-necked Phalarope feeds mainly in the water either on the ocean or in fresh water. When taking its food it swims rapidly in circles dipping its bill into water two or three times during each revolution. The food consists of crustacea, mollusca, worms and insects and their larvae.

References.—Linne, Syst. Nat., 10th ed., 148, 1758 (*Tringa lobata,* Hudson Bay). Bent, Bull. U.S. Nat. Mus., 142, 15, 1927. Mathews, Suppl. Birds Norf. Lord Howe Is., 128, col. pl., 1936.

FAMILY RECURVIROSTRIDAE
STILTS, AVOCETS

Bill long, slender, more or less depressed at base. Tarsus more than twice the length of the middle toe, reticulated in front and behind.

The Stilts and Avocets differ from the Scolopacidae in the bill being depressed at the base, the tarsi reticulated in front and the non-variegated plumage. Three genera are admitted of which two occur in New Zealand.

Key to New Zealand Genera

Bill straight; no hind toe	*Himantopus*
Bill upturned; hind toe present	*Recurvirostra*

GENUS HIMANTOPUS

Bill long, straight, slightly depressed at base, nasal grove less than half length of bill. Tarsus more than twice as long as middle toe and claw; web at base of outer and middle toes; no hind toe.

The straight bill, very long legs and absence of hind toe are distinctive characters. Six species ranging over the whole world.

Key to New Zealand Species

Black above, white below	*H. leucocephalus*
Entirely black	*H. novaezealandiae*

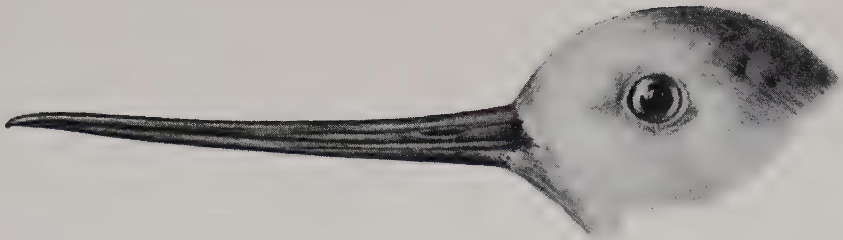
Reference.—Brisson, Orn., 5, 33, 1760 (*Himantopus,* type *Charadrius himantopus* L.).

Pied Stilt. Poaka

Himantopus leucocephalus (semispecies)

The Pied Stilt was first described by Gould in 1837 from specimens obtained in New South Wales. The earliest New Zealand record that I am aware of is a statement by Buller that a specimen was shot in the Waikato district in 1854. Its breeding habits were first described by Potts in 1870.

Adult. Hind neck widening below, upper back, scapulars and upper surface of wings glossy greenish black; under surface of wings



Lily A. Daff

PIED STILT

black. Rest of plumage white including a band across the mantle; central tail feathers tinged with smoky grey. Bill black. Iris and eyelid brick-red. Feet pink, claws black. Bill 61-66, wing 230-250, tail 76-80, tarsus 108-110, mid toe 38-43 mm. *Immature.* Crown and hind neck mottled black and white; a white collar round the lower neck; upper back, scapulars and wings greenish black, some feathers including the quills edged with buffy white; lining of wings black; tail feathers and upper and under tail coverts greyish black edged with buffy; remainder of plumage white. *Juvenal.* Crown and hind neck brown mottled with buffy white, more brown on the crown; upper back, scapulars and wings brown with buff edgings to the feathers; quills greenish black edged with buffy white; tail feathers grey tipped with buffy white; remainder of body white. This plumage begins to moult in January. *Nestling.* Above whitish buff with blotches and longitudinal bands of brown; on the upper back the brown band is double; under surface white. *Colour variety.* A nearly white stilt from the Wairau is described by Buller as an albino of the Black Stilt. It is more likely to be an albino of the Pied Stilt. Buller states that the bird was white stained more or less with ash grey especially on the upper parts; quills and tail feathers white freckled with grey; lining of wings dark ash grey; a few black feathers on the back and among the wing coverts.

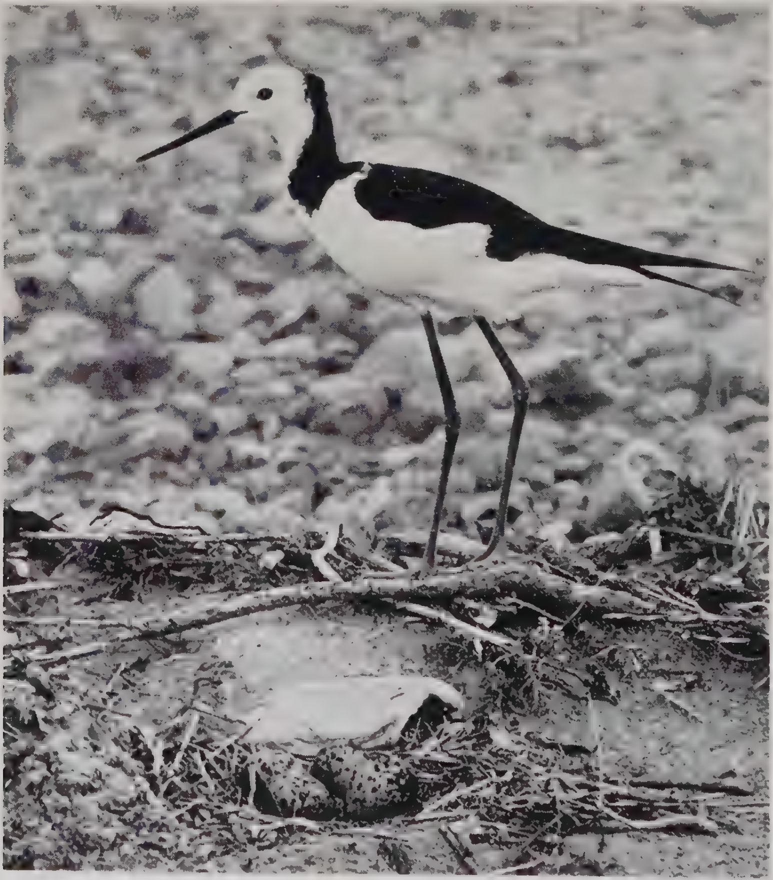
Hybrids. The adult Pied Stilt as described above is what I regard as the normal and, presumably, genetically stable form of the species. Birds which depart from this type in having more black in the plumage are in my opinion hybrids between the Pied and Black Stilts. The series between these last two species includes many different mixtures of their colours and practically every bird is different in its pattern of coloration. They thus exhibit the characteristics which would naturally be expected as a result of crossing the Pied and the Black Stilts. The normal form is found in Australia, Tasmania and north to the Philippines but in these regions the coloration is constant as there is no black species with which it could cross. An exact parallel to this kind of hybridism is found in New Zealand in the case of the Little Pied Shag and the White-throated Shag. The Little Pied Shag is found in both Australia and New Zealand but its darker relative the White-throated Shag is found only in New Zealand. Consequently, intermediate forms are absent in Australia but present in New Zealand. Bowdler Sharpe, in 1896, said of the specimens of New Zealand Pied Stilt which he examined at the British Museum: "Not one is true *H. leucocephalus.* All of them seem to me to have a taint of *H. melas* in their plumage, and the young birds have every appearance of being hybrids between the two forms." Stead records the fact that in 1904 on the Waipara River bed Black and Pied Stilts were breeding in the same colony and there were "several that were obviously intermediates." "Today," said Stead in 1932, speaking of the species generally, "one occasionally sees Pied birds with wholly black head and neck, or perhaps a black patch on the abdomen, and these I consider to have a trace of Black blood in them."

Eggs. Clutch four, ovoid, dark stone colour, marked all over with irregular brownish black blotches and spots, 42 x 29.5, 42.5 x 30.5, 43 x 30, 43 x 30.5 mm. Washdyke Lagoon, same clutch.

Status. In my opinion the Australian and New Zealand Pied Stilts should together be maintained as a species distinct from the northern *Himantopus himantopus,* firstly, because in the adult stage it has the hindneck black whereas in *H. himantopus* it is white, and, secondly, it has a black counterpart in *H. novaezealandiae* with which it interbreeds. The two forms, *leucocephalus* and *novaezealandiae,* are semispecies and thus the Pied Stilt is different biologically from the stilts in other parts of the world. It has yet to be shown that the New Zealand Pied Stilt differs from the Australian one even subspecifically. The two New Zealand species differ very much in colour while the Pied Stilt has a shorter bill and a longer tarsus than has the Black Stilt.

Distribution. Generally distributed and fairly common throughout the North and South Islands from Spirits Bay to Foveaux Strait, in both coastal and inland localities. Kapiti Island. Accidental on Little Barrier Island. Many frequent the larger inland lakes, for example, Rotorua, Rotomahana, Taupo, Brunner, Coleridge and Wanaka.

Philippines, Borneo and Java eastward to



Okuku River, Canterbury *K. V. Bigwood*

PIED STILT

New Guinea and southward to Australia and Tasmania. Some of the Australian birds apparently winter in New Guinea and New Britain. Accidental in Lord Howe and Norfolk Islands.

Ecology. The Pied Stilt frequents intertidal flats in harbours and estuaries, lagoons and marshy places in coastal districts, and river beds, lakes and swamps inland. Large numbers, two to three thousand at a time, have been seen at Lake Ellesmere which is a large sheet of water near the coast and surrounded by wide stretches of swampy ground.

The Pied Stilt is one of the species of New Zealand birds which have benefited by the spread of European settlement. The clearing of forested country has resulted in the increase of its favoured stations. In 1873 Buller said that he knew of only a single instance of its occurrence as far north as Auckland. Now, with the exception of the Banded Dotterel, it is the commonest wader throughout the whole country. According to Sibson and McKenzie the Stilts on the western shore of the Firth of Thames during the 1941-1942 season reared on an average two young per pair. Against this must be put the casualties that would occur during the following winter. There have, of course, been decreases in the stilt population, firstly owing to the increase in density of the European population, for example, Lyttelton Harbour and the Hutt Valley, and secondly through the attention of sportsmen as on the river beds of Canterbury.

At the end of the breeding season stilts move northwards, the birds in inland localities first moving to the coast. They are usually absent from Canterbury from the end of April to the end of July, though Marples records them as wintering near Dunedin. Referring to the stilt population of the Manukau Harbour and the Firth of Thames Sibson and McKenzie state: "In March the numbers begin steadily to increase, and most of the immigrants have settled in for the winter by the end of April. They keep entirely to the mudflats and beaches, over which for feeding they scatter more or less evenly. Towards full tide they mostly congregate at three or four regular resting places. In the winter they do not hesitate to come up among the mangroves, though at other seasons it is not usual to see them there. Numbers begin to decline about the end of July; and a month later there are few left except the breeding pairs and some juveniles."

Food. The Pied Stilt finds an abundance of food in the marshes and intertidal places which it frequents. It wades in shallow water when probing for its prey. Its chief food consists of insects and their larvae, worms, shellfish and other small animals. Stead records finding small fish known as bullies in the stomach of a stilt from the Ashley River.

Voice. When disturbed, the Pied Stilt makes a snapping noise which has been compared to the yapping of a pup, or has been rendered "pink," hence these birds have sometimes been called "pinks."

Nesting. The Pied Stilt builds in colonies sometimes near the nesting colonies of other birds such as Banded Dotterel and gulls. It breeds on shingly river beds, and by the sides of swamps and lagoons, usually placing its nest near the water. Sometimes a mere depression in the ground serves as a nest, at other times it contains a few pieces of roots or grass. In Canterbury, according to Stead, the nest, when placed on shingle or stony ground, consists of a shallow depression lined with a few twigs or rootlets or there may be quite a lot of material, but when placed in swamps it is a more solid construction, being composed of grass, rushes or waterweed, the whole being four to six inches high with a shallow cavity for the eggs.

At Ardmore near Auckland A. F. Stokes was able to watch the nesting of stilts on his farm for several seasons and he has recorded details of the whole process. The birds arrive at the end of July or in August. The eggs are laid in September and October, incubation begins when the third or fourth egg is laid, and takes from 24 to 27 days, the most frequent period being 25 days. In one case in a second brood the egg took 23 days to incubate. The period from hatching to flight is 29 to 38 days. If the eggs or young chicks are destroyed the stilts begin another nest and will have laid a second clutch of eggs within three weeks afterwards. In such a case it will probably be in November that the second clutch is laid.

In Canterbury according to Stead stilts arrive from the end of July and laying commences the third week in September. On one occasion he saw young birds hatched from eggs that must have been laid in July. The stilts leave Canterbury in April, only a few small flocks remaining for a week or two in May.

The manner in which a stilt settles down on its eggs is described by Stead in the following words: "When close to the nest it begins to bend its legs and lower its head. At the edge of the nest it pauses, and with little steps moves its feet up, one on either side of the nest, until they are opposite the centre; then, daintily resting the tip of its bill on the far edge of the nest to balance itself, it gently sinks down on to the eggs."

The young are able to run and swim almost immediately after being hatched, and on being disturbed, lie perfectly still until the danger has passed. On account of their resemblance to the ground they are not easily detected. Running on such stilt-like legs naturally requires a considerable amount of strength, and for this the young are provided with large muscles which show as conspicuous expansions at the tarsal joints. Both boldness and cunning are shown by the adults in the protection of their nests and young. Intruders are attacked at a considerable distance from the nest by the birds diving at them and giving a harsh cry as they pass near their heads. Stidolph quotes the case of a trout fisherman who was attacked in this way for half an hour although the bird was hit with the rod. Nor did it give up the battle until the fisherman went away. If anyone approaches too near the nest the stilt attempts to lead them away by feigning injury, the antics of pretending to drag a broken leg being most ludicrous. Again quoting Stidolph: "It flaps its wings, spreading them out to give the impression that an injury has been suffered, flops itself down on the ground, dances and jumps, all these antics being accompanied by the most pleading cries imaginable."

References.—Gould, Syn. Birds Austr., pt. 2, pl. 34, 1837 (*H. leucocephalus,* New South Wales). Buller, Trans. N.Z. Inst., 7, 222, 1875 (*H. albicollis*); Birds N.Z., 203, 1872; 2nd ed., 2, pp. 21, 27, col. pl., 1888. Guthrie-Smith, Bird Life, 25, 1925. Stead, Life Hist. N.Z. Birds, 97, 1932. Sibson and McKenzie, N.Z. Bird Notes, 1, 51, 1944. Stokes, N.Z. Bird Notes, 3, 107, 1949. Buddle, Bird Secrets, 42, 1951. Wilkinson, Kapiti Bird Sanct., 103, 1952.

Black Stilt. Kaki

Himantopus novaezealandiae
(semispecies)

The first specimens of this species to be brought under the notice of ornithologists were collected in Wellington Harbour and were described by Gould in 1841. The same year, Hombron and Jacquinot described the species under a different name from specimens taken in Otago. Potts, who in 1870 described the breeding habits, stated that the Pied and Black Stilts bred in different communities and he was of opinion that they were quite distinct species.

Adult. Head, neck and under surface brownish black, shading to slaty grey on the face and at base of lower mandible; back, rump and upper surface of wings and tail glossy greenish black. Bill black. Iris and eyelid crimson. Feet pink, claws red. Bill 69-76, wing 240-255, tail 83-90, tarsus 85-95, mid toe 38-40 mm. *Nestling.* Covered with dark brown down. Bill and feet almost black.

Hybrids. Stilts having their plumage intermediate in colour between the Black and the Pied species are undoubtedly hybrids. They are discussed under the Pied Stilt. They have been observed or obtained at Parengarenga Harbour, Manukau Harbour, Waipara River, Lake Ellesmere and other places.

Ahuriri, Canterbury *D. Macmillan*

BLACK STILT

Black and Pied Stilts have been observed as pairs on several occasions. Potts in 1870 said that he did not find the two species breeding together, though the type specimen of his species *spicatus* (or *varius*) is undoubtedly a hybrid between them. In discussing the question of hybridization among the New Zealand stilts Stead said that the decline of the Black Stilt probably was due to shooting and the difficulty of finding mates of its own colour caused it to interbreed freely with the Pied Stilt.

Eggs. Clutch four, ovoid, pointed, stone colour with dark brown blotches all over, 42 x 31.4, 42.8 x 32, 45.4 x 30.5 mm. Ashburton.

Status. On account of its entirely black coloration and different proportions, that is, longer bill and shorter tarsus than the Pied Stilt, the Black Stilt must be accorded full specific rank. It is indeed the only species of black stilt known. Like all the melanistic birds in New Zealand it breeds with its pied congener. In the first edition of this work I called it a mutant of the Pied Stilt, but it is perhaps more probable that the Pied Stilt is the "mutant," in other words, the ancestral form of both species was black. Certain results obtained by crossing rabbits under controlled conditions suggests this explanation. The area of brownish black in the Black Stilt corresponds with that of white in the Pied Stilt. It is evident therefore that the real difference between these two forms lies in a few genetic factors.

Distribution. North and South Islands from Parengarenga Harbour southwards. At present rare everywhere. Apparently it was always more abundant in the South Island than in the North Island. When Europeans began to occupy the country, according to various reports, the Black Stilt was more common than it is at present. Localities from which it has been reported include Kaipara, Manukau Harbour, Lake Rotorua, Lake Rotomahana, Lake Guyon, Lake Brunner, Lake Ellesmere, Tasman River, Waitaki River and Manuherekia.

Nesting. Potts describes the Black Stilt as breeding on sandy river beds, the nest being usually only a depression in the sand, sometimes lined with a little grass and placed near the water. Eggs were found in September and in December. The young can run soon after being hatched and when danger threatens conceal themselves by hiding behind stones. Potts did not find the black and pied stilts breeding together. Like its pied congener the Black Stilt feigns injury in order to attract attention away from its nest.

References.—Gould, Birds Austr., pl. 25, 1841 (*H. novaezealandiae,* Port Nicholson). Hombron and Jacquinot, Ann. Sci. Nat. (2) 16, 320, 1841 (*H. melas,* Otago). Buller, Birds N.Z., 205, 1872; 2nd ed., 2, 24, 1888. Stead, Life Hist. N.Z. Birds, 103, 1932.

GENUS RECURVIROSTRA

Bill curved upwards, much flattened, nasal grooves short, apertures directed upwards. Tarsus covered by small hexagonal scales. Toes webbed, webs indented, hind toe very small.

This genus is at once recognised by the flattened upturned bill and nearly fully webbed toes. Four species divide practically the whole world among them: one in Europe, Asia and Africa; one in North America; one in the Andes and one in Australia.

Reference.—Linne, Syst. Nat., 10th ed., 151, 1758 (*Recurvirostra,* type *R. avocetta* L.).

Red-necked Avocet

Recurvirostra novaehollandiae

The Red-necked Avocet was early discovered in Australia, Vieillot describing Victorian specimens in 1816. It was present in small numbers in New Zealand, chiefly in Canterbury and eastern Otago between 1859 and 1878 and was reported as breeding in a few localities. Buller records seeing small flocks on the Ashburton River and at Timaru in the summer of 1859-1860. However it failed to maintain itself and the only records after 1878 Ashley River, are Invercargill 1892 and Lake Ellesmere 1945.

Adult. Head and neck all round chestnut; inner scapulars and long inner secondaries dark brown; median wing coverts blackish brown; primaries black. Remainder of plumage white, the central tail feathers slightly tinged with greyish. Bill black. Iris dark red. Feet slate blue. Bill 87, wing 225, tail 85, tarsus 90 mm. *Nestling.* Covered with light-coloured mottled down, reddish on the head.

Eggs. Clutch four, long oval, light to deep stone colour with slaty brown to dark brown spots and blotches chiefly at the larger end, 52 x 34, 49 x 32.5 mm.

Distribution. Formerly an occasional visitor, Whangarei, Wellington, Ashley River, Kaiapoi, Christchurch, Lake Ellesmere, Rakaia River mouth, Methven, Ashburton River, Waimate, Timaru, Jackson Bay, Dunedin, Catlins, Invercargill, Lake Wakatipu.

Australia, Tasmania. Accidental in Norfolk Island.

Habits. The Red-necked Avocet frequents the shallow parts of lakes, inlets of the sea and the muddy banks of rivers. It is numerous round the water holes in the interior of Australia. Its food consists of insects and mollusca. The nests are depressions in the mud and are placed close together in colonies. The young leave the nest as soon as hatched.

References.—Vieillot, Nouv. Dict. Hist. Nat., 3, 103, 1816 (*R. novaehollandiae,* Tasmania). Buller, Birds N.Z., 201, 1872; 2nd ed., 2, 20, col. pl., 1888.

FAMILY GLAREOLIDAE
PRATINCOLES

Bill short, decurved at tip, gape wide, nasal grooves wide. Tarsus scutellate in front and behind.

The short decurved bill separates the Pratincoles from the other families of waders.

GENUS STILTIA

Bill short, very broad at base, tip decurved and sharp pointed, gonys well marked, nasal depressions very wide. First primary produced, attenuated. Tail slightly emarginate. Tarsus three times as long as culmen; hind toe present.

The very broad bill, extended outer primary and long legs are distinctive features. The single species is found in the Malay Archipelago and Australia.

Reference.—Gray, Cat. Gen. Birds, 111, 1855 (*Stiltia,* type *Glareola isabella* Vieill).

Australian Pratincole

Stiltia isabella

Only once has the Australian Pratincole been obtained in New Zealand, a specimen having been shot at Westport by J. B. McKenzie in 1898.

Adult. Top of head and upper surface olive-brown, the feathers edged with rufous; outer wing coverts and primaries black; secondaries olive-brown; rump dark brown; upper tail coverts white; tail black tipped with brown, white at base, increasing towards the outer feathers. Lores black; sides of face and throat buff; neck all round and chest rufous; sides of body chestnut; abdomen and under tail coverts white; under wing coverts and axillaries black. Bill red at base, black at tip. Iris brown. Feet brown. Bill 15, wing 198-205, tail 60-65, tarsus 50 mm. In the breeding season in the male the conspicuous chestnut of the flanks meets in front. *Immature.* Rufous margins to the feathers on the upper surface broader than in the adult; face and foreneck with dusky streaks. *Nestling.* Covered with rusty-coloured down with black vermicular markings on the head and back.

Eggs. Clutch two, pale stone colour with irregular grey to dark brown marks all over, 32.5 x 24 mm. (av.)

Distribution. Westport, one occurrence.

Breeds in Australia and possibly south New Guinea. After breeding season migrates to Malay Archipelago from Borneo to Moluccas and New Guinea.

Habits. The evolution of similar structures for like purposes from different material is illustrated by this species. It feeds on insects which it picks up on the ground but it also hawks for its food like swallows and to this end is provided with long pointed wings and a wide gape. The Pratincole arrives in Australia during September and October and breeds shortly afterwards. It leaves again during April. It nests on the bare stony ground in the interior of Australia, selecting for the place to lay its two eggs a bare clay patch, or clearing a space by scratching away the stones. As with most of the plovers the young are able to run soon after being hatched and closely resemble their surroundings, while the parents in order to entice away visitors feign injury.

References.—Vieilliot, Anal. Nouv. Orn., 69, 1816 (*Glareola isabella,* Australia). MacGillivray, Emu, 24, 81, 1924. Bailey, Emu, 35, 1, col. pl., 1935.

ORDER LARIFORMES

GULLS, SKUAS, TERNS

Bill straight or slightly curved, the tip straight or curved downwards, lower mandible with a prominent gonys. Front toes fully webbed; the hind toe short and slightly elevated. Tail feathers 12. Young covered with down when hatched and able to run in a short time.

Key to Families

Bill with upper mandible decurved at tip and overlapping lower mandible. Tail square or rounded.	
Bill without a cere	*Laridae*
Bill with a cere	*Stercorariidae*
Bill straight or slightly decurved, both mandibles of equal length. Tail forked	*Sternidae*

FAMILY LARIDAE. GULLS

Bill stout, compressed, tip decurved and overhanging the lower mandible, no cere. Tail usually square or rounded. Toes webbed in front, hind toe small.

The Gulls are distinguished from the terns and noddies by the bill being bent down at the tip and the short square tail, and from the skuas by the small claws and the absence of a cere.

Genus Larus

Bill two or three times as long as deep; nostrils linear, gonys well marked. Hind toe well developed, free; lower portion of tibia bare. Tail square.

Comprises 34 species found in all parts of the world except Polynesia.

Key to New Zealand Species

Back black	*L. dominicanus*
Back pearl grey.	
Bill red	*L. novaehollandiae*
Bill black	*L. bulleri*

Reference.—Linne, Syst. Nat., 10th ed., 136, 1758 (*Larus,* type *L. marinus* L.)

Black-backed Gull. Karoro

Larus dominicanus

This common gull does not appear to have been specifically mentioned in the accounts of Cook's voyages. Forster did not leave a drawing of it nor mention it in his *Descriptio Animalium.* The Black-backed Gull was first described by Lichtenstein in 1823 from specimens collected in Brazil. Although one of the most common and conspicuous birds on our coasts it does not appear to have been listed as a New Zealand species until Gray, in Dieffenbach's *Travels in New Zealand* in 1843, included it under the name *Larus fuscus.* The *Erebus* and *Terror* expedition collected it at the Auckland Islands in 1840, and in the report of the voyage it was also recorded from Mount Egmont.

Adult. General plumage white; back and upper surface of wings black; the scapulars and secondaries with a broad terminal band of white; first primary with a broad subterminal bar of white and tipped with white, the rest tipped with white. Bill bright yellow, red on the gonys. Iris silver-grey. Feet greenish yellow. Male: bill 50-58, wing 390-434, tail 152-168, tarsus 61-71, mid toe 58-67 mm. Female: bill 46-49, wing 390-400, tail 153-160, tarsus 58-61, mid toe 56-59 mm. In the living birds the females are noticeably smaller than the males. In the Black-backed Gull the adult plumage is practically assumed after two moults, that is, when the bird is about two and a half years old. As each moult takes a few months to complete several phases of plumage are passed through. After the second moult the only signs of immaturity may be brown flecks on the head and neck, a paler bill than in the adult and occasionally some black on the tail. There is thus a first year or juvenal and a second year or immature plumage to describe.

Immature. Head, neck and under surface mottled brown and white; back brownish black; wings brown, the feathers more or less edged with buff; primaries and tail brownish black; upper and under tail coverts white barred with brown. Bill grey, black on the gonys and horn coloured at the tip. Eye black. Feet bluish white. As the bird passes to maturity, when it is about two years old, mature and immature characters are mixed, and we get a phase like the following: White; back, quills and tail black; wing coverts and secondaries brown edged with buff; scapulars brown tipped with white. Bill pale yellow with pale red patch on gonys. Eye black. Feet yellowish green. *Juvenal.* Head and neck brown streaked with white; back brown with buff edgings to the feathers; rump, upper and under tail coverts barred brown and white; primaries and their coverts black; remainder of wing coverts brown, tipped with buff. Tail black, narrowly tipped and basally mottled with buff. Bill black. Iris black. Feet pinkish brown. *Nestling.* Head creamy buff, with large irregular blackish brown spots; upper surface greyish buff obscurely spotted with brown; under surface light greyish buff. Bill black. Feet dark lead colour. *Colour varieties.* A number of variations are recorded by Buller, including pure white (one from Manawatu, another from Tahoraiti); a conspicuous white spot on each wing; white back and white spot on each wing (immature).

Eggs. Clutch two or three, ovoid, stone or dark stone colour with large dark and pale brown blotches chiefly at the larger end. The

Kapiti Island *A. S. Wilkinson*

BLACK-BACKED GULL

ground colour varies, sometimes being greenish, 72 x 47, 70.5 x 48, 69 x 50 mm. Rakaia River. 67 x 48.5, 71.2 x 51 mm. Chatham Islands. 69 x 48, 75.5 x 52 mm. Kapiti Island.

Status. Although attempts have been made to define subspecies of *Larus dominicanus* several ornithologists who have handled large numbers of specimens are of the opinion that the supposed differences have not been proved constant enough to warrant subdivision of the species. It is closely allied to the Great Black-backed Gull of the North Atlantic of which it may be said to be a representative species filling the same ecological niche.

Distribution. Kermadec Islands, accidental; North, South and Stewart Islands, including Little and Great Barrier Islands. Mayor Island, White Island, Kapiti, D'Urville Island, Solanders. Chatham Islands. Snares, Auckland, Campbell, Antipodes, Bounty and Macquarie Islands. Abundant and breeding on the coasts throughout. Inland it is found less plentifully. It visits the lakes in the centre of the North Island breeding at Lake Taupo and Lake Rotorua. It ascends the rivers on the eastern side of the Southern Alps breeding far from the coast and it breeds high up on the Rock and Pillar Range in Otago and the Paparoa Range in Westland.

Circumaustral in temperate latitudes. Its normal northern breeding limits are 6° S. Lat. in northern Peru, Tropic of Capricorn at Rio Janeiro and at Walfisch Bay in South Africa, 30° at Durban and 34° 20′ in the New Zealand region. Its southern breeding limits are West Antarctica, South Shetlands, South Orkneys, South Georgia, Falkland Islands, Tristan da Cunha, Gough Island, Marion, Crozet, Kerguelen, Heard and Macquarie Islands. Straying to Ecuador and accidental in New South Wales and Lord Howe Island. It is not found breeding in the Australian region, its place being taken by its ecological counterpart the Pacific Gull.

Ecology. The Black-backed Gull is abundant all along the coast, and more especially in harbours where it congregates in large numbers in the vicinity of freezing works. It is also found inland on river beds and lakes and, indeed, almost anywhere. On one occasion while standing on the Blimit above Arthur Pass at an altitude of over 6,000 feet, I observed several Black-backed Gulls sailing overhead and calling in the manner they do when their nests are approached. In stormy weather they come inland partly, no doubt, to avoid the storm but apparently also to feed on the worms which come to the surface in wet weather. On the coast the Black-backed Gull mixes freely with the smaller gulls and terns; it is, however, hunted by the skua, apparently its only rival, where the range of the two species overlaps. It does not go very far away from land nor probably does it move far from its breeding place. On Macquarie Island, Ainsworth states that it remains all the year round.

Birds that have been tamed when young and allowed to fly away have sometimes returned to the place where they were reared and from these occurrences it is known that the Black-backed Gull can attain an age of at least 28 years.

Whilst the clearing of forest, scrub and swamp involved in the advance of European settlement has for the most part been destructive to native bird life, it has provided an increased supply of food for some kinds of birds and these, in response, have multiplied their numbers. Among these species are the pipit, the harrier and the three species of gulls. There can be little doubt that Black-backed Gulls, now provided with an abundance of food by shipping, freezing works, whaling stations and farm lands, have increased in numbers since Europeans established themselves. It is now common almost everywhere where man has settled and set up industries. Indeed it readily forms an association with man who, it soon learns, seldom interferes with it.

The Black-backed Gull is a most useful scavenger in harbours and in the vicinity of freezing works where it congregates with the

Red-billed Gull and consumes large quantities of offal. It is also useful in gardens and fields as it consumes caterpillars and snails, while Stead has reported that it eats large black beetles which infest turnip crops. A tame one is recorded as killing sparrows which came to feed on the fowls' food. Against these good qualities must be placed the fact that whenever the opportunity presents itself, it kills birds and preys on their young and eggs, not sparing chickens round the homestead. Its worst crime, however, is the killing of lambs and sheep. Its victims may be old sheep with a heavy fleece which may fall and be unable to rise, or weak lambs. If the Black-backed Gull finds any such it eats the eyes, pecking back into the brain, and also eats the tongue.

When I visited Stephen Island in 1922 Mr. F. Woodbury, the principal lightkeeper, told me that the Black-backed Gulls nesting on the island destroyed large numbers of tuataras. A gull waits at a burrow for hours until a tuatara emerges, grabs it and then flies to sea and back to its nest, dropping the tuatara every now and then to kill it. Sometimes, if the water is rough, it loses its prey.

Food. The food of the Black-backed Gull consists of all kinds of animal matter. Every kind of animal cast up by the waves is greedily devoured, whether fresh or putrefying, including carcases of whales and seals, dead fish and birds. It feeds largely on bivalve molluscs—Dosinia, Amphidesma, Mactra, Chione and others—breaking the shell by carrying it to some height and dropping it on hard sand or on rock. Undigested pieces of shell are afterwards brought up in otherwise soft pellets. It also feeds on the eggs and young of birds, especially the terns near which it breeds; on any adult birds it is able to catch; and on grubs and worms which it finds on its inland excursions.

Small fishes are caught, sometimes from the surface of the sea off shore and sometimes from tidal pools. Freezing works and whaling stations provide the Black-backed Gull with an abundance of offal and accordingly this species is well represented among the birds which frequent such places.

Voice. The young has a shrill whistle which it repeats almost continuously so that it becomes rather trying in tame birds. The adults' most characteristic cry is a laughing sound hence the name Laughing Gull by which it is known in some districts. It also utters a whistling note and a harsh "ha-ha-haro" when disturbed in its breeding ground.

Nesting. The Black-backed Gull breeds in scattered colonies on shingly riverbeds and coastal rocks and beaches. A nest has been found on a mountain side near Lake Wakatipu at an elevation of over 5,000 feet above sea level. On the southern end of the Paparoa Range in Westland, at an elevation of about 3,000 feet, in a patch of tussock grass, there is a large colony of Black-backed Gulls breeding. Sea shells and sheep bones found in the locality showed that the food supply of these birds came from the coast about six miles distant. Stead reports a nesting colony at a similar height above sea level on the Rock and Pillar Range.

November is the usual time for laying and three the most common number of eggs in a nest, though two and very occasionally four are found. The nest varies from a mere hollow in the sand with a few pieces of grass or sedge, such as on the sand dunes at Houhora, to a large volcano-shaped structure of grasses and other plants. On the slopes of Rangitoto the nests are large and made entirely of the leaves of Astelia. The upper portion of the nest is composed of dry leaves, but the base consists of more or less decomposed leaves and earth. It is evident, therefore, that the birds build up the old nest each year. On the Rakaia River bed the nests are large and for the most part composed of grass including small tussocks pulled up by the roots. A nest from Milford Sound in the Canterbury Museum was composed of seaweed, rushes, twigs and grasses closely pressed together. On the lower Rakaia riverbed the Black-backed Gull breeds near a large colony of White-fronted

Terns and a smaller one of Black-billed Gulls. Stead records that two pairs in this locality fed their young almost entirely on young terns and gulls, taking their prey despite the clamour and attacks of thousands of the smaller species.

On the Rakaia River bed the laying season extends from October to December, most birds beginning to lay in early November. Chicks are common in early December. On Kapiti Island Wilkinson gives the period of incubation as 29 days.

Wilkinson records further that the young leave the nest when a few days old, and can swim when a week old. They can fly when five to six weeks old and can fend for themselves at seven weeks, but they are occasionally fed by the parents until they are three months old.

References.—Lichtenstein, Verz. Doubl. Zool. Mus., Berl., 82, 1823 (*L. dominicanus,* Brazil). Buller, Birds N.Z., 270, col. pl., 1872; 2nd ed., 2, 47, 1888. Guthrie-Smith, Mutton Birds, 44, 1914. Dwight, Bull. Amer. Mus. Nat. Hist., 52, 223, 1925. Stead, Life Hist. N.Z. Birds, 42, 1932. Murphy, Ocean. Birds S. Am., 2, col. pl., 1057, 1936. Falla, B.A.N.Z.A.R.E., ser. B, 2, 234, 1937. Buddle, Bird Secrets, 59, 1951. Wilkinson, Kapiti Bird Sanct., 129, 1952. Oliver, Notornis, 5, 82, 1953.

Red-billed Gull
Tarapunga, Akiaki

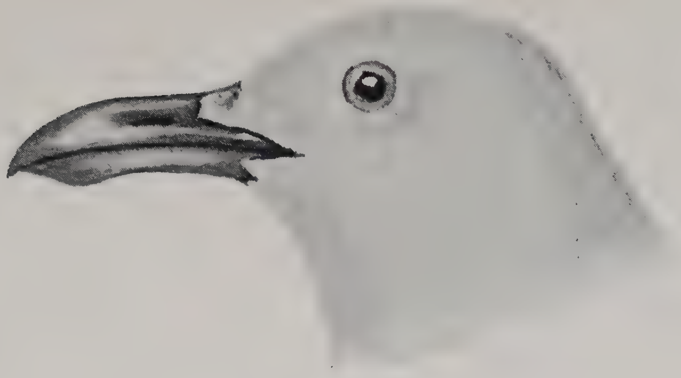
Larus novaehollandiae scopulinus

Though this species bears an Australian name it was first discovered by an ornithologist in New Zealand in 1773. During Cook's second voyage, Forster encountered it in Dusky Sound. He stated that it occurred along the rocky coasts of the South Island, lived on fish and entered inlets for the purpose of breeding. The Red-billed Gull was next collected at the Auckland Islands in 1840 by the naturalists of the Antarctic Expedition under Sir James Ross, and in the report of the expedition was recorded also from Mount Egmont. It was stated, too, that it was numerous at the whaling stations especially during the season for taking the whales.

Adult. General colour white; back, scapulars and upper surface of wings pale grey; anterior edge of wings and first four greater coverts white; first and second primaries black with base, a broad band near the tip and the tip white; third to sixth primaries white with the terminal portion black, all tipped with white; remaining quills ash-grey. Bill arterial red. Iris silvery lemon,

G. A. Buddle

RED-BILLED GULL CHICK



C. McCann

RED-BILLED GULL

eyelid pale red. Feet arterial red, paler than the bill, claws dark brown. Bill 29-33, wing 280-300, tail 115-125, tarsus 43-48, mid toe 42-48 mm. *Immature.* Similar to adult but with brown blotches on the middle wing coverts. First and second primaries black with small white patch near the end; next four primaries lower part grey on inner, white on outer webs, upper part black with white tips. Inner primaries and secondaries grey with brownish black patch near tip, the innermost secondaries largely blackish brown. Bill reddish at base, blackish at tip, paler on basal part of mandible. Iris dark brown, eyelid black. Feet pale red. *Juvenal.* Wing coverts and scapulars blackish brown edged with fulvous; tail feathers with subapical bar of blackish brown on the inner webs. Remainder as in the immature stage. Bill and feet dark grey.

Nestling. Upper surface dark buff, spotted with black. Head paler and spots smaller. Under surface buff. *Colour varieties.* There is a pure white specimen in the Otago Museum, another was taken at Titahi Bay in 1929 and Mr. J. Belton informed me that in October, 1935, at Plimmerton, a white gull frequented the beach for several weeks.

Eggs. Clutch two, ovoid, greenish stone, marked all over with light and dark brown blotches, 52.5 x 35.5, 50 x 37.5 mm. White Island. 54.4 x 37.6, 54 x 40.5 mm. Campbell Island.

Status. Five subspecies of *Larus novaehollandiae* are recognised by Dwight in his monograph on the gulls. The New Zealand subspecies, *scopulinus*, differs from the typical subspecies of Australia in being a little smaller, in the bill and feet being bright arterial red, and in the upper part of the third primary usually being black without a white patch below the white tip. It resembles closely the subspecies *hartlaubi* of South Africa, both subspecies having mirrors on the two outer primaries only.

Distribution. Abundant in the North Island, South Island (least common in Westland and Canterbury), and Stewart Island; and all the islands adjacent to the coast; also Three Kings, Little and Great Barrier Islands, Poor Knights, Hen and Chickens, Mokohinau, Mayor Island, White Island, Kapiti, Solander, Chatham, Snares, Auckland and Campbell Islands. Inland it is found at Lake Rotorua and Lake Taupo, and has been recorded at Lake Brunner and Lake Manapouri. Straggler to Lord Howe Island.

Ecology. The Red-billed Gull is very common along the coasts, especially in harbours where it associates with the Black-backed Gull. It is also found inland on lakes though not so abundantly as on the coast. At Waiotapu in the thermal lakes district, according to Phillipps and Lindsay, a colony of about 150 Red-billed Gulls once nested

Caswell Sound *K. V. Bigwood*

RED-BILLED GULL

on warm ground in the vicinity of hot pools until, on account of earth movements, the pools dried up.

The winter quarters of the gulls that breed on Mokohinau appear to be mainly Manukau Harbour and the Firth of Thames. According to P. C. Bull's observations in these localities the gulls arrive from their breeding places during February, March and April, and mostly return in July and August.

The Red-billed Gull has almost certainly increased in numbers since the arrival of Europeans principally on account of the increased supply of food that has taken place as a result of the establishment of whaling stations, freezing works, farms and shipping centres.

Food. All kinds of animal food are eaten by this species; lizards, fish and fish spawn, shrimps, insects and all kinds of dead animal matter cast up on the beaches. The berries of the taupata, a small coastal tree, are greedily eaten, also, according to Buddle, puka berries on the Three Kings. This gull has been observed by A. H. Watt, at Awanui, hawking for large insects from near the ground to a height of 200 feet. It frequents whaling stations and freezing works, associating with the Black-backed Gull in feeding on offal. It is common in all our seaports where it feeds on garbage and other waste that is always to be found where shipping congregates. The birds become quite used to human beings which are allowed to approach them within a few feet. Often residents of the sea coast feed the Red-billed Gulls which gather daily at meal times and become tame enough to feed out of the hand.

Red-billed Gulls are unmitigated robbers and are always to be seen in the breeding places of shags, gannets and terns. Here they not only pick up scraps of food but, as has been observed by Stead, actually force young shags, which have just been fed by their parents, to disgorge the food which is then immediately eaten by the gulls. With smaller birds such as the oystercatcher they are more predatory, compelling their victims to give up the crabs and other animals which they have dug out with their long bills. Mr. J. H. Mihell, onetime lightkeeper at the Brothers, informs me that he has seen Red-billed Gulls swoop on an unguarded tern's egg, pierce it and raise it up a few feet and drop it, but before the gull can reach the broken egg another gull may pounce on it.

One of the most interesting sights to be seen off shore is the flight of Red-billed Gulls following a shoal of fishes which are also being harassed from below by kahawai (*Arripis trutta*). The moving masses of birds is in constant circulation and the activities of the pursued and pursuing fishes result in a very disturbed piece of water.

Red-billed Gulls follow the plough, swarming excitedly round the newly made furrow and pouncing on the worms and insect larvae which are exposed. They flock to parks and open grassy places in the coastal towns, especially after rain when earthworms come to the surface. This gull is thus entirely a beneficial species.

Nesting. The Red-billed Gull generally selects for its breeding sites small rocky islands, placing its nest along the rocks and tussock-covered slopes close to the water's edge. The largest nesting colonies are at the Three Kings Islands and Mokohinau. Buddle estimates the number of birds at the Three Kings at 100,000. At Mokohinau there are about ten nesting grounds on Burgess islet and estimates of the total number of breeding birds are as high as 30,000 (Buddle). Among other nesting islands are Cuvier Island, White Island, Rurima Rocks, Sugar Loaves of New Plymouth, Kapiti, Solanders and Codfish Island; also Chatham, Snares, Auckland and Campbell Islands. There are nests at various places along the coast of the North and South Islands and inland in the thermal lakes district.

Sometimes the nests have very little lining, but generally they are well formed of various plant stalks and leaves that are at hand. At Mokohinau Buddle describes the nest as "a substantial structure of seaweed, twigs and leaves lined with grass." On White Island the nests are composed of stalks of Mesembryanthemum lined with grass. On an islet off Kapiti, Wilkinson describes them as nearly all made of seaweed, though sometimes they are built of Mesembryanthemum. Nest building here is thus described by Stidolph: "The presumed female appears to gather the nest material, some of which is picked up right alongside the nest site, though other material is gathered from much further afield. When the material, often pieces of seaweed, is placed in the nest site, the female squats in the cup, with the breast pressed down and works her feet backwards to shape the cup. The male stands by and watches, though when the female is absent he may sometimes mould the nest in the manner described." On Mana Island the nests are placed on ledges on the precipitous sides of the island. They are well made of sticks, grass and the wiry stems of Muehlenbeckia. The nesting season extends over some months. On White Island on December 7th, fresh eggs, nestlings and nearly fully-fledged young were seen. Stidolph records eggs as being laid during the first half of November on an islet off Kapiti. On Campbell Island R. L. Oliver reports that Red-billed Gulls' eggs were found late in Novem-

G. A. Buddle

RED-BILLED GULL

ber, nestlings in early January and fledglings in February. The habit of nesting at the same place every second year only has been observed at Mokohinau and the Alderman Islands, but this rule is not strictly observed as Buddle found that on Mokohinau the gulls bred during two consecutive seasons. Gurr states that the Red-billed Gull breeds when two years old and that both sexes share in the incubation of the eggs.

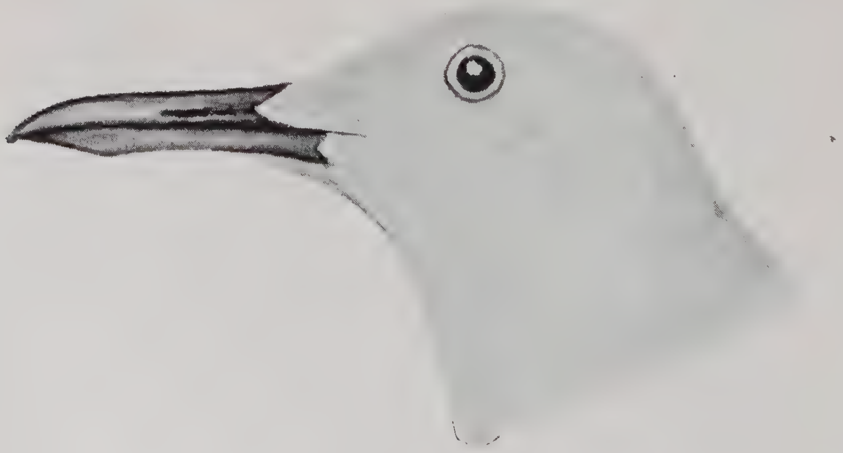
At Mokohinau Buddle says that the week-old chicks are fed on "a mess of partly digested, tiny pink shrimps; it looks just like salmon paste, as the old birds regurgitate it, and push it down the throats of the young." The food of nestlings at Nelson was found by Gurr to consist entirely of insects.

References.—Stephens, Shaw's Gen. Zool., 13, 196, 1826 (*Larus novaehollandiae,* New South Wales). Forster, Desc. Anim., 106, 1844 (*L. scopulinus,* Dusky Sound). Buller, Birds N.Z., 273, 1873; 2nd ed., 2, 55, col. pl., 1888. Dwight, Bull. Amer. Mus. Nat. Hist., 52, 279, 1925. Guthrie-Smith, Bird Life, 12, 1925. Buddle, Bird Secrets, 56, 1951. Wilkinson, Kapiti Bird Sanct., 136, 1952. Turbott, Rec. Auck. Mus., 4, 141, 1951. Gurr, Notornis, 5, 208, 1954.

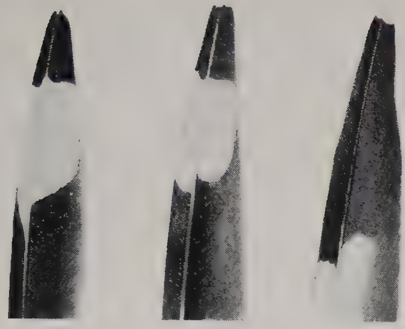
Black-billed Gull. Tarapunga
Larus bulleri

The recognition of this species as distinct from the Red-billed Gull was first due to Bruch who, in 1855, described it as a new species. Buller, not accepting Bruch's bird, also described it as new, his specimens being obtained in the South Island about 1869. The specific names given by both Bruch and Buller had, however, already been applied to a species of Larus so that a change was required and this was effected by Hutton who dedicated the species to Buller.

Adult. General colour white; back, scapulars and upper surface of wings ash-grey; breast suffused with rose which is evanescent; outer four primaries white with subterminal black bar, fifth and sixth grey with subterminal black bar. "Bill dark reddish black. Feet dark blood red." (Stead.) Iris silvery white. Bill 37-38, wing 270-295, tail 108-115, tarsus 43-44, mid toe 38-40 mm. *Immature.* Similar to the adult but bill pale orange with black tip; eyes black; feet orange or reddish. The changes of bill, eye and feet colour do not always proceed together or in the same order. *Juvenal.* General colour white; a broad pale brown band across the crown, a narrow one on the nape and a spot on each side of the neck; back, scapulars and upper surface of wings pale grey with brown subterminal patches on the feathers which are edged and tipped with white or buff. The amount and distribution of the brown varies a good deal. First two primaries black with white base and mirrors; third to fifth white with black edges and terminal bars; all tipped with

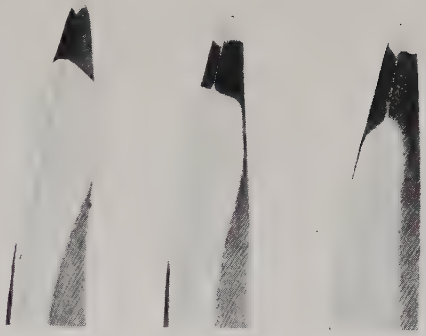

C. McCann

BLACK-BILLED GULL



R. J. Jacobs

RED-BILLED GULL
First three primaries



R. J. Jacobs

BLACK-BILLED GULL
First three primaries

white. Bill pale reddish with black tip. Iris black. Feet pale reddish. *Nestling.* Light buff, grey or brown, spotted with black; under surface white. Bill and feet pale pink.

Eggs. Clutch two or three, ovoid, pale olive-green with dark and light brown blotches. The ground colour is variously coloured pale grey, stone or even pale blue. 56 x 37.5, 55 x 36.5, 53 x 38 mm. Rakaia River.

Status. The Black-billed Gull comes close to the Red-billed Gull but is distinguished by the bill being longer and less deep; by the black or reddish black colour of the bill; and by the outer primaries being mostly white. The changes in the colour of the bill from the nestling to the adult are from pale pink; through orange or reddish with dark tip, to black. In the Red-billed Gull the changes are from black, through reddish with black tip, to arterial red.

Distribution. In the past three or four decades the Black-billed Gull has increased in numbers considerably and spread northwards in the North Island. At present it breeds in some hundreds in the Rotorua district, these birds wintering in the Firth of Thames and Bay of Plenty. It occasionally breeds on the coast in Hawke's Bay. In the South Island it is common throughout but mostly on the eastern side of the main divide. It is not common in Westland. A bird ringed on the Ashley River was later found alongside the Manawatu River.

Ecology. The increase in the population of Black-billed Gulls which has been noticeable in the past thirty or forty years has clearly been due to the extra food available through the operations of man. The birds are becoming quite a feature of towns and villages where they pick up food in the streets or gardens and often are fed by the people. On the coast it is largely centred in the seaports. It is especially characteristic of lakes and shingly river beds and birds breeding in these stations move to the coast in winter. The Arctic Skua, present in the summer months, is the chief bird that preys on the Black-billed Gulls, not by killing them but by harassing them when returning from fishing excursions. To escape from the skuas, the gulls disgorge their fish and the skuas catch them in mid-air even though there are several falling at once. On the nesting grounds the enemies of the Black-billed Gull are Harriers, Black-backed Gulls, stoats and occasionally hedgehogs.

Food. The food of the Black-billed Gull consists for the most part of small fishes and of insects. "Either the birds fly low over the surface of the water, and dive down on any fish; or they stand on the side of the stream and run into the water and catch fish that may swim by. When diving after fish, these gulls go in with the wings extended and held backwards, the birds being very rarely completely submerged, and usually only putting its head and neck under water." These words, quoted from Stead, are followed by further and interesting details of the method of fishing from the shore. Insects, for example moths and beetles, are often taken on the wing. A few trout fry are taken by the Black-billed Gull, but altogether the bird is a useful one on account of the insects it devours both by following the plough, which it sometimes does, and by its own industry.

Nesting. On the wide shingly river beds of Canterbury very large breeding colonies of this species exist, several hundreds of nests being found together. Further north and south the breeding colonies are smaller. Along the coast the Black-billed Gull generally selects shingle or sand banks for laying, but sometimes rocky headlands are used. The swamps round Lake Ellesmere also are the nesting places of the Black-billed Gull. The nests are placed close together, sometimes side by side and in such cases disputes are, according to Stead, settled by the adjacent parties screaming at each other. The nests are usually quite low, but well made of roots and small sticks and lined with grass. In swamps they may be built up to a height of nine inches. According to Guthrie-Smith nesting sites are selected in mid-October and by the end of the month a few eggs are laid. The first half of November is the period when most of the eggs are laid. Stead records three instances which indicate that the bulk of the eggs in a breeding colony are laid on the same day. He gives the period of incubation as about twenty days and states that the young can run within 24 hours of being hatched, are able to fly when 26 days old, and breed when two years old. On the Whitestone River in Otago, on December 9th, I found in a colony of over 280 nests that incubation was nearly over, only eight nests having eggs in them. Many chicks were running about and into the water, some swimming out from the shore. The parents were at the same time excitedly endeavouring to herd them back to the shore as the current quickly carried them down stream.

Guthrie-Smith states that "Nidification is a perfunctory business with the Black-bill, the sitting bird often beginning to incubate her earliest laid egg in a most meagrely furnished nest. Building, however, does not then cease; her mate still for days after the full clutch has been laid, will continue to provide fresh material. It is carefully dropped

Lake Ellesmere *K. V. Bigwood*

BLACK-BILLED GULL

from a foot or two above on to her back; thence gripping it with her bill she slides it off right or left as may be required and safely tucks it beneath her."

References.—Hutton, Cat. Birds N.Z., 41, 1871 (*Larus bulleri*). Buller, Birds N.Z., 276, col. pl., 1873; 2nd ed., 2, 58, col. pl., 1888. Dwight, Bull. Amer. Mus. Nat. Hist., 52, 293, 1925. Guthrie-Smith Sorr. Joys N.Z. Nat., 130, 1936. Stead, Life Hist. N.Z. Birds, 50, 1932.

FAMILY STERCORARIIDAE. SKUAS

Bill with a cere; tip of upper mandible hooked. Toes fully webbed, furnished with large, hooked claws.

Key to Genera

Central pair of tail feathers projecting under 2 cm. .... *Catharacta*
Central pair of tail feathers projecting more than 7 cm. .... *Stercorarius*

Genus Catharacta

Bill massive, depth at base nearly equal to length of cere. Tarsus rather shorter than middle toe and claw. Central pair of tail feathers projecting very little beyond the others.

These skuas are more robust than those belonging to the genus Stercorarius (Jaegers) and are further distinguishable by the deeper bill, relatively longer tarsus, and scarcely elongated central tail feathers.

Four species found in all seas but most abundant in the colder regions. Some ornithologists consider that only one species should be recognised.

Key to New Zealand Species

Neck with straw-coloured streaks only .... *C. antarctica*
Neck distinctly straw-coloured *C. maccormicki*

Based on colour and size the Skuas may be grouped in six or more forms. Each has its own breeding range with slight overlapping in one or two localities. In his book *Oceanic Birds of South America,* Murphy treats the forms as subspecies of a single species, *C. skua,* but is not sure about it because "Claims in the literature . . . indicate that more than one kind of skua may nest in the same locality. . . . Such a situation . . . would indicate that the various representatives of the group are biologically more distinct from one another than is suggested by their differences of colour or dimensions." Considering that some forms are more closely related to one another than to others we ought to admit two grades, namely, specific and subspecific, to express their affinities, as was done by Mathews. I see no good reason to reject Ridgway's classification into four species. We can hardly expect to understand the Skuas until a careful investigation is made of the breeding colonies on each of the islands where they are found.

References.—Brunnich, Orn. Boreal., 32, 1764 (*Catharacta,* type *C. skua* Brun.). Bonaparte, Compt. Rend., 43, 643, 1856 (*Megalestris,* type *C. skua* Brun.).

Southern Skua. Sea Hawk. Hakoakoa
Catharacta antarctica lonnbergi

The Southern Skua, or, as it is more commonly called in New Zealand, the Sea Hawk, was taken off the east coast of the South Island in 1770 during Cook's first voyage. The Russian explorer Bellinghausen in 1820 visited Macquarie Island where one of the crew, without moving from one spot, shot twenty "Egmont Hens." At Campbell Island, in 1840, the Southern Skua was taken by the British Antarctic Expedition under Sir James Ross. On the mainland it seems first to have been noticed by Hector in Breaksea Sound about 1862, and it was obtained at the Chatham Islands by Travers in 1871. It was found breeding on Macquarie Island by J. H. Scott in 1880 and at the Snares, Auckland and Antipodes Islands by A. Reischek in 1888.

Adult. Head and neck brown; feathers of neck with yellowish shafts; remainder of upper surface dark brown; blackish on the wings; some scapulars and upper tail coverts margined with white; quills and tail feathers white at the base. Under surface buffy brown; axillaries and under wing coverts dark brown. Bill and feet black. Iris dark brown. Bill 56-63, wing 404-450, tail 142-

178, tarsus 71-82, mid toe 80-90 mm. *Immature.* General colour slaty brown, paler below; scapulars with pale margins. *Nestling.* Covered with brownish grey down, bill blackish, feet blue grey. *Colour variety.* A bird with scattered white feathers was photographed by J. H. Sorensen on Campbell Island.

Eggs. Clutch two or three, ovoid, dark stone colour with irregular blotches of dark and light brown mostly at the larger end. 75.4 x 51, 77.6 x 54.8 mm. Chatham Islands. 73 x 52.5, 74 x 52 mm. Campbell Island. 74 x 53.8 mm. Auckland Islands. 78.8 x 53.6 mm. Macquarie Island. 78 x 52 mm. Islands off Stewart Island.

Status. The Southern Skua can be separated from the Antarctic Skua by its darker coloration, and from the Arctic and Chilean Skuas by the absence of chestnut in the plumage.

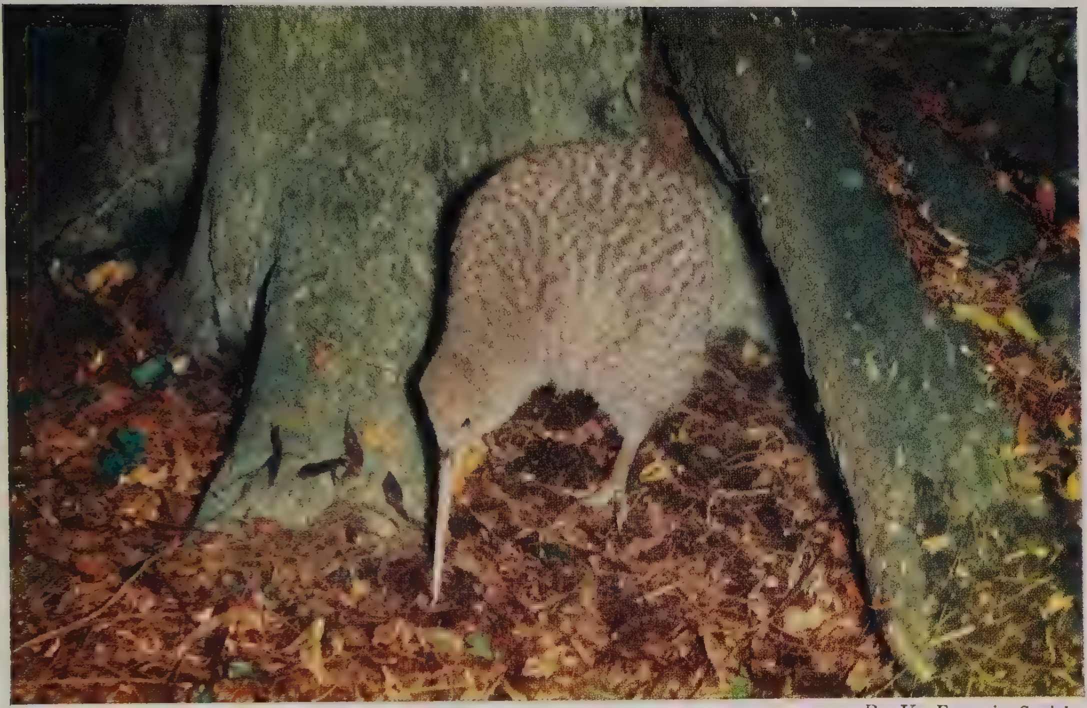
Distribution. North Island: occasional visitor, reported from Three Kings Islands, Whangarei, Muriwai beach, Cape Egmont, and Kapiti Island. South Island: sparingly found on the north and east coasts from Astrolabe Bay to Banks Peninsula and Otago Peninsula; resident in Fiordland and Foveaux Strait. Breeding sparingly in Fiordland, abundantly on islands adjacent to Stewart Island, Solander, Snares, Auckland, Campbell, Antipodes and Macquarie Islands. In the Chatham Group breeding on Mangere, Little Mangere, Pyramid Rock and South East Island. Visitor to the Bounty Islands where probably the Bounty Island Mollymawks keep it from establishing itself.

The southern oceans, mainly between 40° and 60° S. Lat., though reaching 65° S. Lat. in West Antarctica. Breeds in West Antarctica, South Shetlands, South Orkneys, South Georgia, Bouvet, Prince Edward, Crozet, Kerguelen and Heard Islands. Accidental in southern Australia and Norfolk Island.

Ecology. The Southern Skua is found in the subantarctic temperature zone of ocean

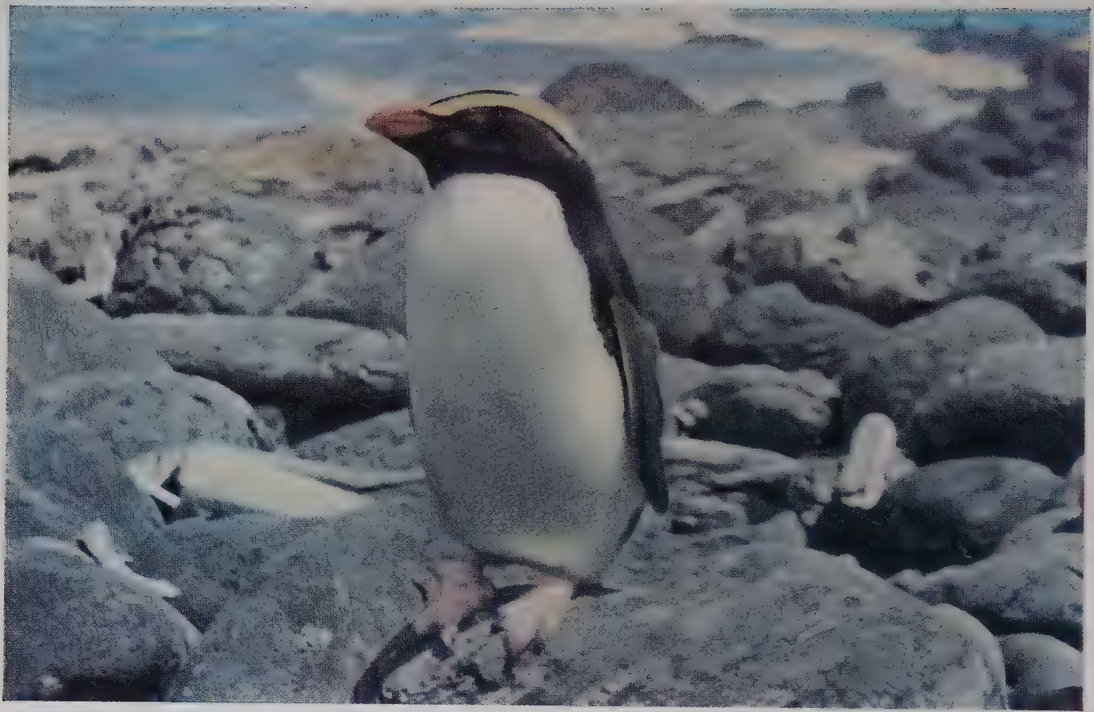
Campbell Island *J. H. Sorensen*

SOUTHERN SKUA



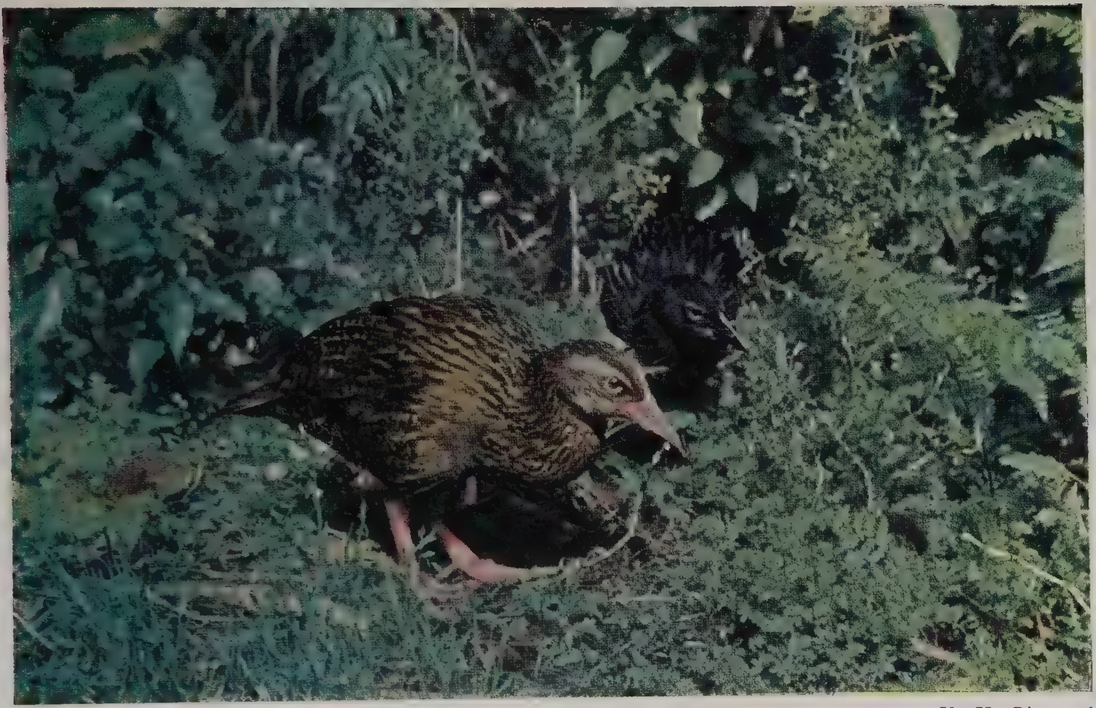
R. V. Francis Smith

LARGE GREY KIWI



R. R. Forster

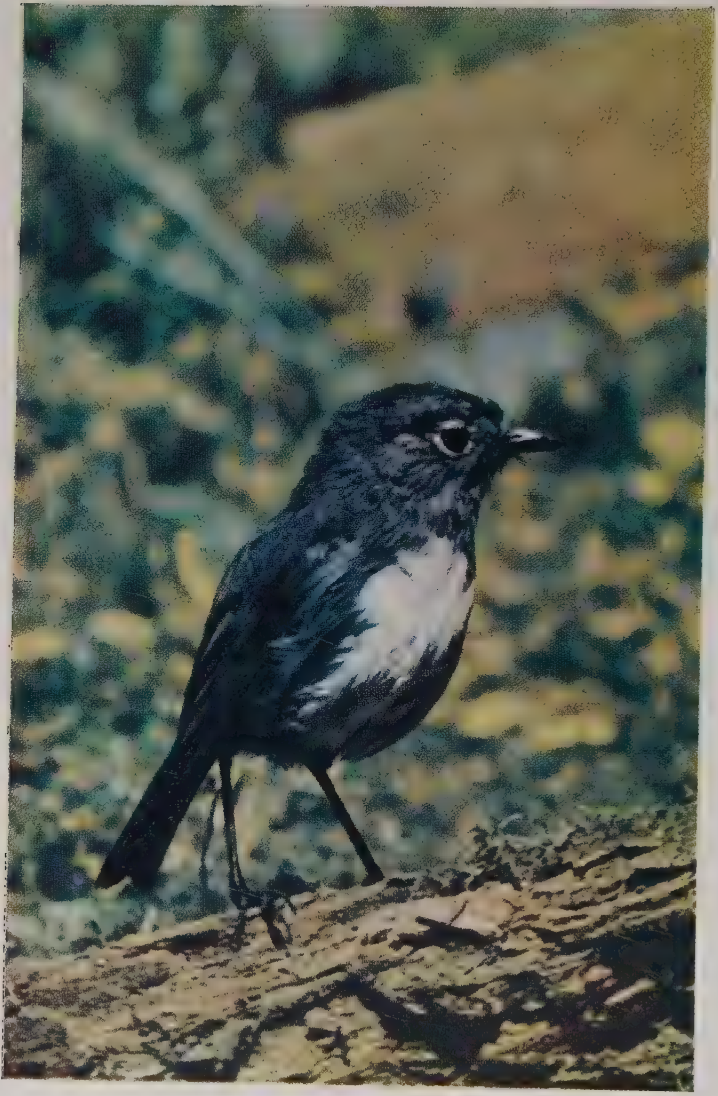
FIORDLAND CRESTED PENGUIN



K. V. Bigwood

SOUTH ISLAND WEKAS

Chestnut and black phases

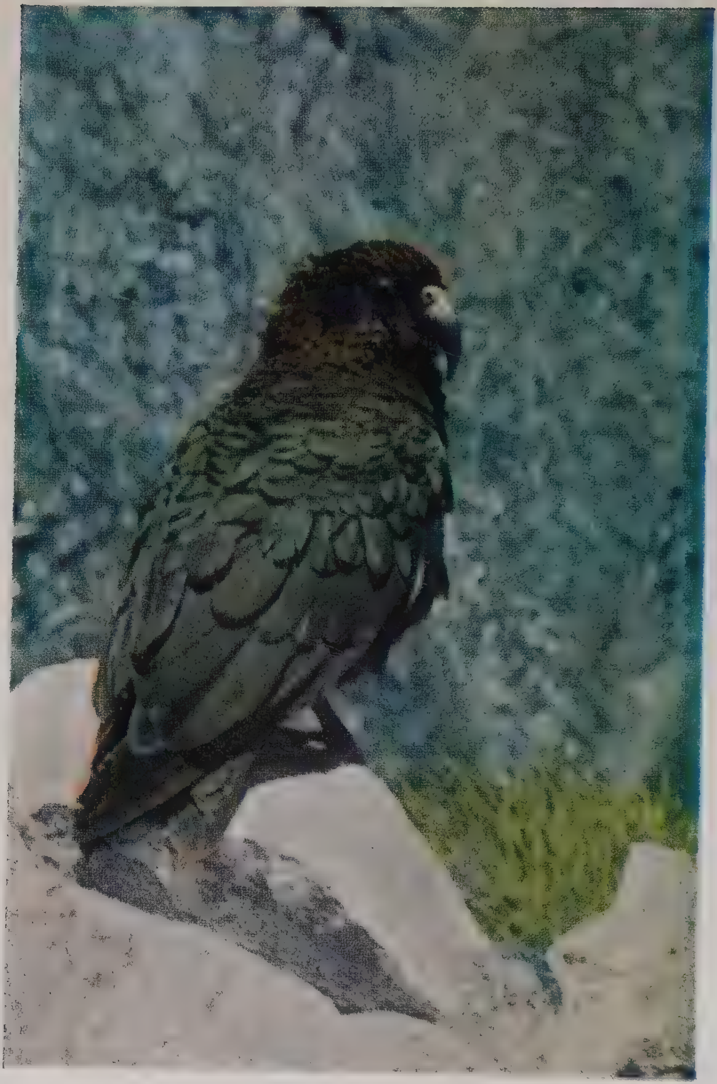


K. V. Bigwood

SOUTH ISLAND ROBIN

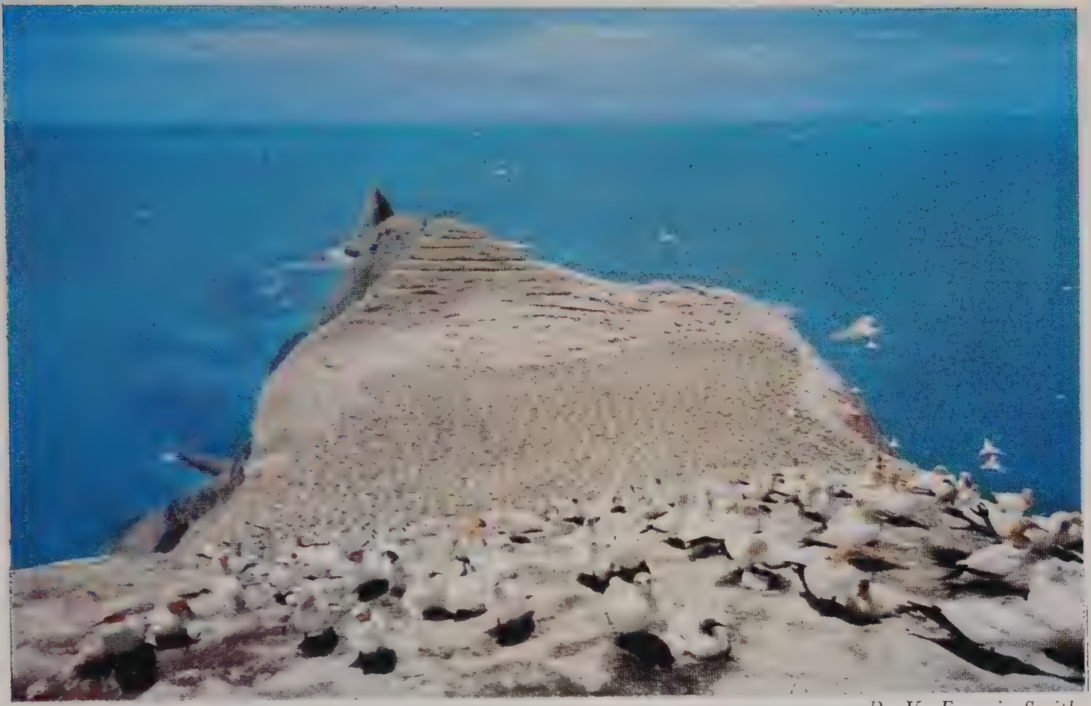
K. V. Bigwood

KINGFISHER



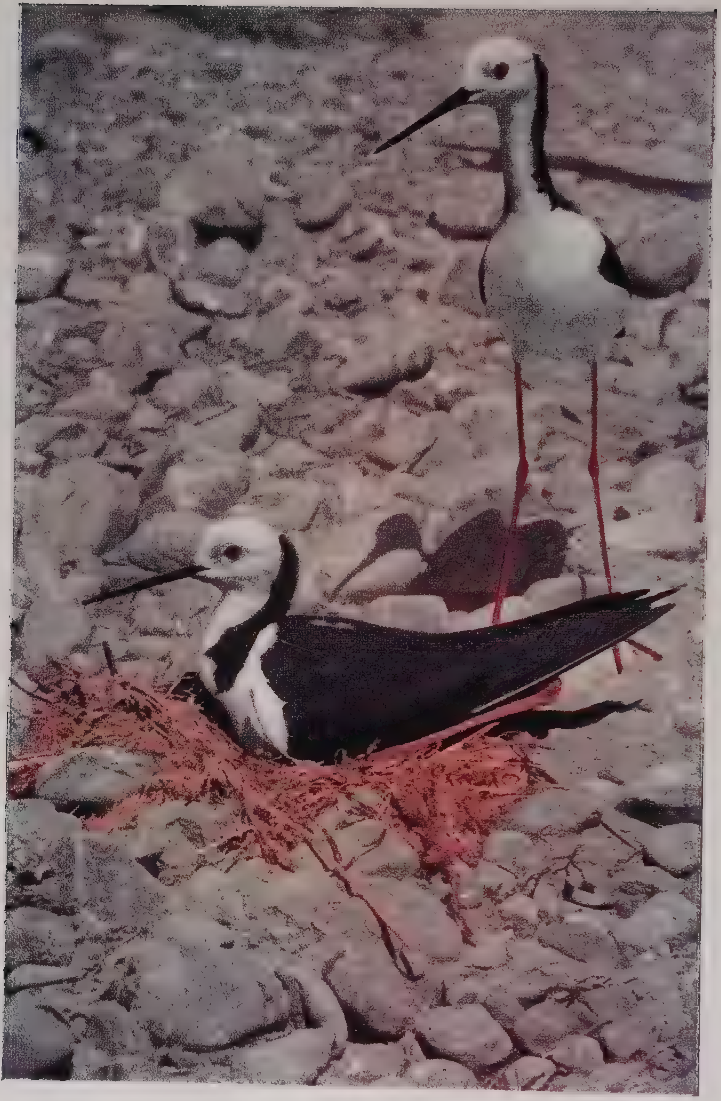
K. V.. Bigwood

KEA



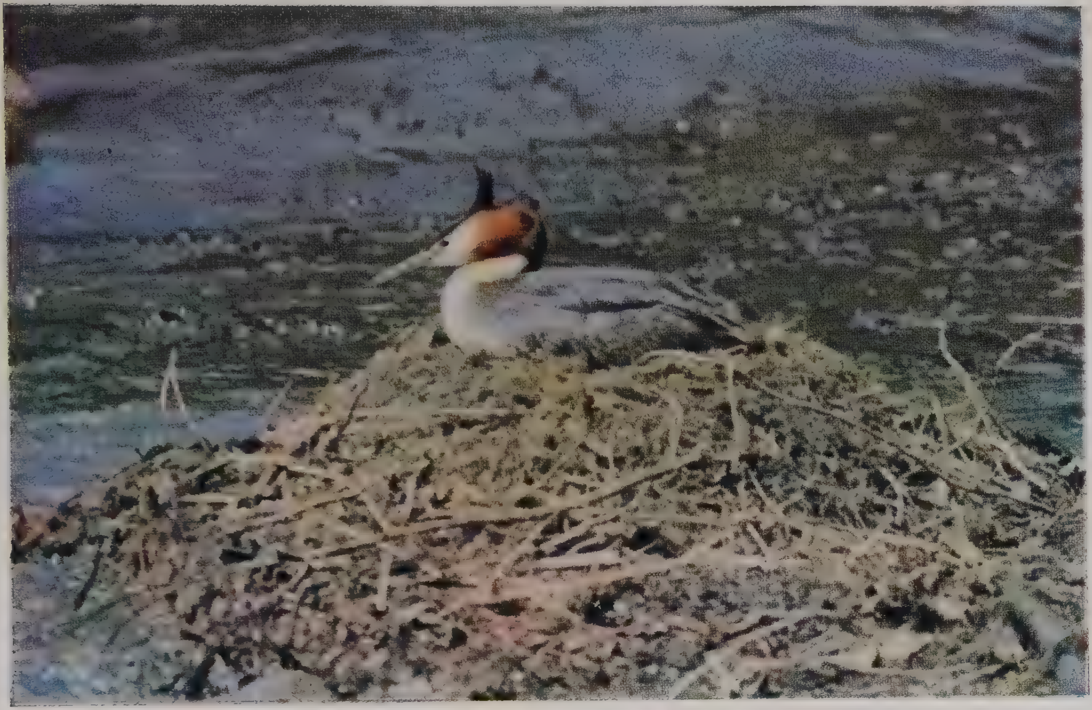
R. V. Francis Smith

GANNETS AT CAPE KIDNAPPERS



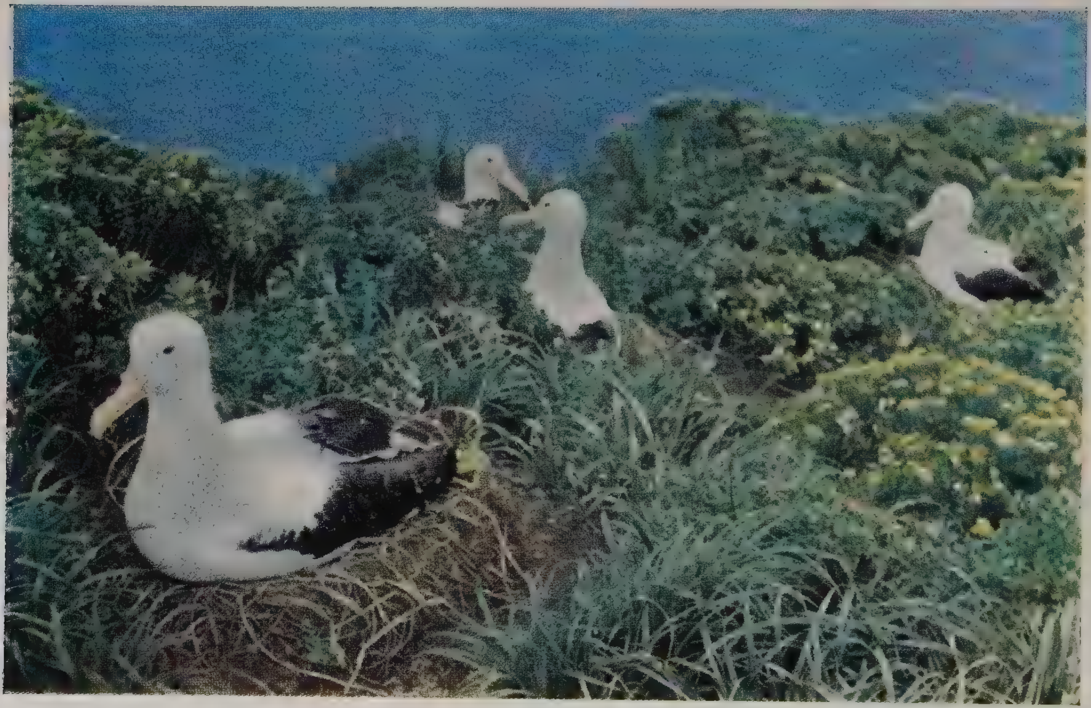
K. V. Bigwood

PIED STILT



R. V. Francis Smith

CRESTED GREBE



W. H. Knox

CHATHAM ISLAND ROYAL ALBATROSS

Islands off Stewart Island *E. F. Stead*

SOUTHERN SKUAS

waters and in the northern portion of the Antarctic zone, the breeding stations being in the subantarctic zone, except those in West Antarctica and the South Shetlands, which are well within the Antarctic zone. Like the gulls the Southern Skua is a shore bird. It is found on islands where there are large colonies of petrels and penguins, though itself being in comparatively small numbers as each pair requires the exclusive use of the coast for fifty yards or more from its nest. In the winter months, when all the petrels and most of the penguins are at sea the Skuas are known to leave Macquarie and Campbell Islands, presumably to seek warmer waters.

Skuas are so few in number compared with penguins and petrels that their predatory habits have little effect on the colonies of penguins and the smaller petrels. It is possible, however, that the skuas may appreciably reduce the numbers of White-headed Petrels on the Antipodes and Auckland Islands and the Mottled Petrels on the islands off Stewart Island.

Skuas were so destructive to young penguins and their eggs on Macquarie Island that the sealers were forced to poison them. On Campbell Island and on the Chatham Islands they attack sheep that are down and they attack newly born lambs.

Food. No animal food, whether freshly killed or decomposed, comes amiss to the Southern Skua. Its main food are the birds it kills and the eggs it steals, and as it establishes itself in or around the breeding grounds of petrels and penguins it has an abundant supply of fresh food for about eight months of the year. For fresh food in the winter time it would have to hunt further afield, but at all seasons there are chances to feed on dead seals, whales or birds, also smaller animals on the sea surface and coastal rocks. Swift in flight it relentlessly pursues its prey and savagely destroys it. The smaller birds it swallows whole, later disgorging pellets of feathers and bones. Large birds are partially plucked, torn apart and swallowed, generally in fairly large pieces.

The Sea Hawk is a most audacious plunderer, pursuing other birds as large as the Black-backed Gull until they give up their prey, when the Sea Hawk immediately pounces upon it often catching it before it reaches the water. Prions, storm petrels and diving petrels suffer greatly from the Skua, so also do the large White-headed Petrels on Antipodes and Auckland Islands. It is a rapacious robber of penguins' eggs and young, and likewise of albatross eggs. It will stand by an albatross' nest waiting an opportunity to pounce upon the young or egg. It attacks pigeons and kakas travelling between Stewart Island and the outlying islets, attempting and sometimes succeeding in forcing them down into the sea when it easily kills and devours them.

Writing of the Snares Islands, E. F. Stead says: "On a patch of bare rock at the edge of a penguin rookery, Skuas had their larder. Here were remains of their feasts: mutton birds, whale birds, and another that I afterwards identified as the mottled petrel. The skeletons were picked bare, the heads, which could be swallowed whole, had gone, and only the wings remained; but of the diving petrels that the Skuas had doubtless taken, nothing was to be seen, for they are swallowed whole, feathers and all."

The method adopted by the Skuas of robbing penguins of their eggs and young was thus described by Mr. R. K. Dell who visited Antipodes Island in November 1950. When a Skua arrives at a penguin colony it merely settles and stands still. The penguins protest vigorously and in their excitement one or more is sure to leave its egg. The Skua immediately picks it up and carries it away to where it can eat it. It breaks the shell with one stab of its beak. After it has finished the contents of the egg pipits and parakeets clean up the scraps.

Nesting. At Macquarie Island, according to Ainsworth, the Sea Hawk arrives early in August but does not start nesting until the beginning of October. The nests, built of grass and leaves, are placed on the ground, the ideal site being a Pleurophyllum flat adjoining a penguin colony. Two or three eggs are laid about the end of October and from this time until the young are reared, the Sea Hawks fiercely attack intruders by swooping down and attempting to strike them with their wings. The young are fed by the parents disgorging food which

Campbell Island *J. H. Sorensen*

SOUTHERN SKUAS

is immediately picked up and devoured.

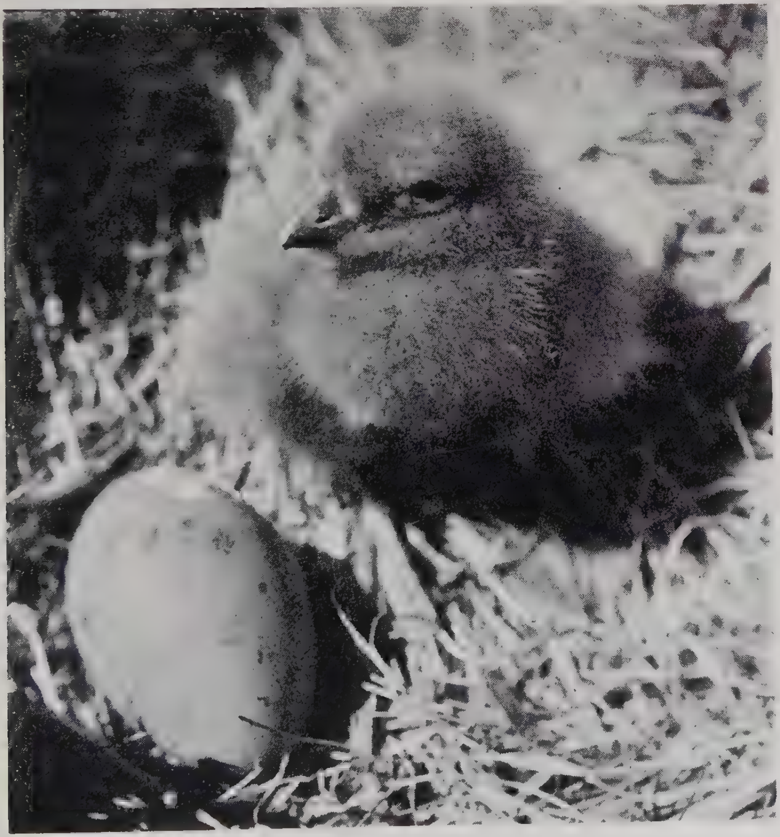
An intensely interesting account of the breeding habits of the Sea Hawk on islets off Stewart Island has been published by Guthrie-Smith. This observer states that the nest is a shallow structure, often a mere depression in the turf. Three adult birds are always in attendance at each nest, two males and a female. Each of them at times sits, but the hen is the most eager to incubate the two eggs.

Stead says that not always are there three Skuas in attendance at each nest, but when there are three they consist of the two parents and one young male of the previous season's brood.

At Campbell Island, according to R. L. Oliver, the breeding cycle is as follows. In August a few birds are seen and they return in force during September. Pairing off takes place in October. The first eggs were found on November 10th and the first chicks on December 6th. A fully feathered chick was seen on February 17th. By mid-March they were flying. They became fewer in April and May, the last bird being seen on June 3rd.

At Macquarie Island members of the Australasian Antarctic Expedition, 1911-13, observed the first Skuas in August. The first eggs were found on October 22nd and 24th. Chicks appeared during the first half of December. Richdale says that at the Snares the young were almost fully fledged at the end of January, and Stead noted birds on Cundy Island, off Stewart Island, flying at the end of February.

The Southern Skua lays two eggs and



Campbell Island *J. H. Sorensen*

SOUTHERN SKUA CHICK AND EGG

both are hatched but it is unusual for both chicks to be reared. On Campbell Island, says Sorensen, the "parents usually devour one of their offspring soon after it is hatched." At Whero Island, off Stewart Island, Richdale says that "After hatching the chicks soon forsake the nest and take cover in the surrounding vegetation, coming forth only when the parents land with food." Food for the chicks is swallowed by the parents and, on arrival at the nest, disgorged on the ground.

The strange ceremony of feeding the chick when three adults are present is thus described by Guthrie-Smith. Always the three adults were present and the chick was carefully manoeuvred into the centre. One then disgorged food which was eaten by the young bird, all three adults assisting him. During the whole performance the necks of the old Sea Hawks were lowered to the ground and stretched to their fullest extent; while any food not required by the chick was shared by the adults.

References.—Lesson, Traite Orn., 616, 1831 (*Lestris antarcticus,* Falkland Islands). Buller, Birds N.Z., 267, 1872; 2nd ed., 2, 63, 1888. Mathews, Nov. Zool., 18, 212, 1912 (*C. antarctica lonnbergi,* New Zealand seas). Guthrie-Smith, Bird Life, 175, 1925. Waite, Subant. Is., 2, 556, 1909. Stead, Life Hist. N.Z. Birds, 60, 1932. Mathews, Suppl. Birds Norf. Lord Howe Is., 21, col. pl., 1936. Falla, B.A.N.Z.A.R.E., ser. B, 2, 240, 1937 Fleming, Emu, 38, 497, 1939. Sorensen, Wild Life Subant. Is., 11, 1951.

Antarctic Skua

Catharacta maccormicki

This almost purely Antarctic species was first collected at Possession Island, Victoria Land and in the pack ice during the voyage of the *Erebus* and *Terror,* and was described by Saunders as a distinct species over fifty years afterwards. Only storm cast specimens have been found in the New Zealand area. Four, all from the west coast of the North Island, have been recorded, namely, Rangitikei, January 1940; Muriwai, April, 1940; Mitimiti, Hokianga, about 1946; Waikanae, March, 1953. The specimen on which the species was admitted to the New Zealand list in the first edition of this book is now in the Canterbury Museum and is *Catharacta antarctica lonnbergi.*

Adult. Crown brown, forehead and sides of head light brown; neck conspicuously streaked with yellow or straw coloured, tapering feathers; remainder of upper surface dark brown. Basal portion of primaries white. Under surface pale buffy brown, shading to coffee brown on the abdomen. Bill and feet black. Bill 46-53, wing 385-415, tail 135-169, tarsus 62-67, mid toe 64-75 mm. (Falla's mmts.) *Immature.* Differs from the adult in having the head and neck dark brown, the under surface blackish grey and the feet bluish. *Nestling.* At first covered with "grey-blue down, which subsequently turns brownish, apparently as a result of absorption of oil from the subcutaneous tissues." (Murphy.)

Eggs. Clutch two, dark stone colour with irregular blotches of dark and light brown, mostly at the larger end. 66.5 x 49.6, 73.5 x 51.8 mm. Cape Adare.

Status. The Antarctic Skua clearly differs in colour from all the other skuas and, furthermore, in West Antarctica, its breeding area overlaps that of *C. antarctica lonnbergi.*

Distribution. Four occurrences, Mitimiti (Hokianga), Muriwai, Rangitikei, Waikanae.

Antarctic and subantarctic seas, breeding on the coast of the Antarctic continent and adjacent islands. In summer it wanders far south over the polar ice. In winter it occurs chiefly at sea and in the pack ice. Accidental in the western Pacific, sometimes north of the equator. A single specimen has been reported from Ceylon.

Habits. The Antarctic Skua is seldom found far away from the ice. It is resident on the Antarctic coast from the end of October to the early part of April. Its eggs are laid in December, and the chicks are hatched a month afterwards. Wilson states: "Their habits are in every way like those of other Skuas, and having no other gulls to attack, as have their northern relatives, they content themselves by attacking one another or the smaller petrels on the wing till the weaker disgorges what he has eaten. . . . The Skua's real harvest begins as soon as the Adelie Penguin lays its eggs. But the Skua even robs its own kind. Mr. Ferrar gave me a further instance. A nestling Skua which had wandered to the beach was seen, seized and carried out to sea by one of the Skuas, followed by a clamouring crowd, all eager to rob the owner of its prey. . . . There is never any attempt at nest-making other than the shallow depression in the gravel on which the eggs are laid."

References.—Saunders, Bull. Brit. Orn. Club, 3, 12, 1893 (*Stercorarius maccormicki,* Victoria Land). Wilson, Nat. Ant. Exp. Aves, 64, 1907. Mathews, Birds Norf. Lord Howe Is., 110, col. pl., 1928. Murphy, Ocean. Birds S. Amer., 2, 1016, 1936. Falla, B.A.N.Z.A.R.E., ser. B, 3, 247, 1937; Emu, 40, 119, 1940. Fleming, Notornis, 5, 182, 1953.

GENUS STERCORARIUS

Bill compressed, depth at base less than length of cere. Tail with central pair of feathers projecting far beyond the others. Tarsus longer than middle toe and claw.

Differs from Catharacta in its smaller size, long tail feathers and relatively long tarsus. There are three Arctic species ranging in the northern winter into the southern hemisphere.

Key to New Zealand Species

Middle pair of rectrices broad throughout, rounded terminally, their distal half twisted	*S. pomarinus*
Middle pair of rectrices tapering, acuminate, not twisted	*S. parasiticus*

Reference.—Brisson, Orn., 6, 149, 1760 (*Stercorarius,* type *Larus parasiticus* L.).

Pomarine Jaeger

Stercorarius pomarinus

The inclusion of the Pomarine Jaeger in the New Zealand avifauna is based on a specimen in the Auckland Museum shot by A. B. Deeming at the Bay of Islands in December, 1933, and by several sight records.

Adult—Light phase. Pileum, lores, upper surface except nape and hindneck, sooty grey; sides and back of neck tinged with straw yellow; sometimes brown band across breast; under tail coverts brownish grey; rest of body white. Bill brownish, terminal third black. Feet black, upper portion of tarsus bluish. Bill 38-44, wing 350-374, tail (middle rectrices) 172-243, tarsus 48-54, mid toe 42-47 mm. *Adult—Dark phase.* Sooty greyish brown, tinged with yellowish over ears. *Immature—Light phase.* Head, neck and under surface buff barred with dusky, the bars indistinct on head and neck. Upper surface dusky greyish brown; scapulars tipped with buff. *Immature—Dark phase.* Sooty greyish brown; breast, abdomen and sides narrowly, tail coverts above and below broadly barred with buff. *Nestling.* Greyish brown down, paler on under surface.

According to Southern five to fifteen per cent. of birds belong to the dark phase but they do not segregate for breeding.

Eggs. Clutch two-three, ovate, smooth, brownish olive, sparingly spotted with chestnut brown and grey. 72.6 x 44.9, 57.2 x 43.6 mm. (av. 64 x 45 mm.).

Distribution. Bay of Islands. Sight records: Whangaroa Harbour, Clevedon, Kaiaua, Ponui Island.

Arctic seas, breeding on the coasts and islands of Europe, Asia and North America. Winters in the southern Atlantic and Pacific oceans as far south as West Africa and Peru, straying to Australia and New Zealand.

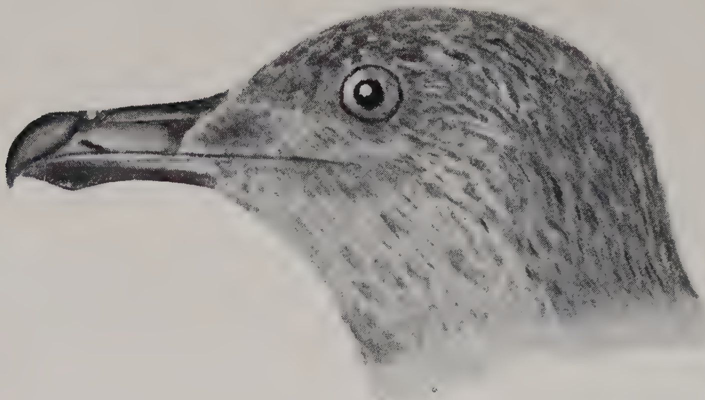
Habits. According to C. B. Hill, who discovered a nest on an island in the Yenesei River, the nest was a mere depression in the ground on a spot rather drier than the surrounding marsh. In Greenland Kumlien found the species breeding on inaccessible cliffs half a mile from the seashore.

References.—Temminck, Man. d'Orn., 514, 1815 (*Lestris pomarinus*). Falla, Rec. Auck. Mus., 2, 4, 1936.

Arctic Skua. Parasitic Jaeger

Stercorarius parasiticus

The Parasitic Jaeger or Arctic Skua is a frequent summer visitor to the coasts of New Zealand. The first recorded specimen was



C. McCann

PARASITIC JAEGER

shot by Buller at Horowhenua in 1864. Since that time the species has been observed or obtained in New Zealand on many occasions. Both the dark and the light phases visit New Zealand.

Adult—Light phase. Top of head, lores, back, wings and tail greyish brown, the primaries and tail feathers darker; primaries with white shafts; rest of head and neck straw-yellow. Chin and breast white; abdomen, under wing coverts, and under tail coverts greyish brown. Bill light horn colour. Iris brown. Feet black. Bill 28-35, wing 300-340, tail (middle rectrices) 164-235, tarsus 39-46, mid toe 33-37 mm. *Adult—Dark phase.* Sooty brown, the neck more or less tinged with straw-yellow; primaries with white shafts. *Immature—Light phase.* Head and neck cinnamon-buff streaked with dusky brown; upper surface dark greyish brown, the feathers edged with cinnamon-buff. Under surface cinnamon-buff barred and spotted with brown. *Immature—Dark phase.* General colour greyish brown, the wings and tail darker; the scapulars, wing coverts, and upper tail coverts edged with pale buff, neck all round streaked with greyish white; the under parts, except the chest and breast barred with greyish white. According to Saunders the young of the cross between light and dark birds is intermediate in character, having a dusky whitish throat, more or less of an ash-brown band across the breast, and a considerable amount of brown on the flanks. *Nestling.* Sooty brown above, paler below. The downy young of dark parents are deepest in colour.

Eggs. Clutch two, ovoid, dark stone colour to greenish buff with dark and light brown spots and blotches mostly at the larger end, 57 x 41 mm. (av.)

Status. Distinguished by the length of the central tail feathers which project about 7 cm. and are thus much shorter than those of the long-tailed jaeger (*S. longicaudus*). From the pomarine jaeger (*S. pomarinus*) it is distinguished by the tail feathers being acuminate and not twisted.

Distribution. A regular summer visitor. Moderately common along the coast of the North Island and of Nelson and Marlborough. Less frequent further south. Among the localities where it has been recorded are: Mokohinau, Hokianga, Bay of Islands, Muriwai, Hauraki Gulf, Alderman Islands, Napier, Wanganui, Kapiti Island, Lake Wairarapa, Wellington Harbour, Farewell Spit, Tasman Bay, Cloudy Bay, Banks Peninsula, Rakaia mouth, Taieri beach, Dusky Sound, Chatham Islands.

Arctic and subarctic regions, breeding as far south as 55° 45′ North latitude in Scotland. In the northern winter it is found over the coasts of most parts of the world as far south as Argentina, South Africa, Australia and New Zealand.

Habits. In New Zealand the Parasitic Jaeger is to be seen during the summer months mostly between October and April, but Sibson has recorded it in the Firth of Thames as early as August 25th and as late as May 24th. It associates especially with flocks of White-fronted Terns, in harbours and off shore, and near their breeding colonies, for the purpose of robbing them of their prey.

Food. In New Zealand the Parasitic Jaeger is known to feed on fish only which it obtains by robbing sea birds on the wing. But in the northern hemisphere, where it goes ashore to breed, this species not only robs other birds of their fish but also feeds on their eggs and young, on small animals, on mammal remains cast up on the beaches, and on the berries of shrubs (*Empetrum nigrum*). The method by which this Jaeger obtains food taken by other birds is well known and has many times been described. The following account is by R. H. D. Stidolph recorded at Napier. "Sometimes two Skuas were seen chasing one Tern. As soon as a Tern succeeded in making a catch it often found itself chased by one of these Skuas, which invariably compelled the Tern to drop the fish, which was seized by the Skua in most cases before it reached the water. On one or two occasions the Skua which made the Tern disgorge found the fish seized by another Skua." While the White-fronted Tern is the usual victim of the Parasitic Jaeger, it occasionally, according to McKenzie and Orum, chases Caspian Terns "but it is only on two occasions that we have seen one victimise a Red-billed Gull."

Nesting. The Parasitic Jaeger arrives in the Polar lands of North America, Europe and Asia during May and lays during June and July. It breeds as far north as Greenland, Spitzbergen and Franz Josef Land. The nest is a depression in the tundra, sparingly lined with lichen or grasses.

References.—Linne, Syst. Nat., 10th ed., 136, 1758 (*Larus parasiticus,* Sweden). Buller, Birds N.Z., 268, 1872; 2nd ed., 2, 66, 1888. Saunders, Cat. Birds Br. Mus., 25, 327, 1896 (*S. crepidatus*). Bent, Bull. U.S. Nat. Mus., 113, 14, 1921. Falla, Rec. Auck. Mus., 2, 4, 1936.

FAMILY STERNIDAE. TERNS, NODDIES

Bill straight or slightly curved, rather slender, both mandibles of equal length. Wings long, pointed. Tail forked. Feet small.

Key to New Zealand Genera

- Tail forked (Terns).
  - Tail feathers rounded .... *Chlidonias*
  - Tail feathers pointed.
    - Bill stout. Tail short .... *Hydroprogne*
    - Bill slender. Tail long .... *Sterna*
- Tail emarginate, graduated (outer rectrices shorter than the next pair) (Noddies).
  - Tail feathers rounded .... *Anous*
  - Tail feathers pointed.
    - Middle toe and claw shorter than bill .... *Gygis*
    - Middle toe and claw longer than bill .... *Procelsterna*

Genus Chlidonias

Bill short, culmen less than twice length of tarsus. Tail short, forked, less than half length of wing, rectrices rounded. Toes long and sharp-pointed; webs indented.

Distinguished from Sterna by the short bill, short tail, rounded rectrices and indented webs. A cosmopolitan genus of four species. The New Zealand species include one resident and one visitor.

Key to New Zealand Species

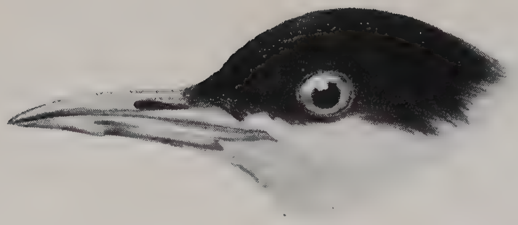
- Head grey, except top which is black .... *C. albostriata*
- Head black .... *C. leucoptera*

References.—Rafinesque, Kentucky Gaz. 36, 3, 1822 (*Chlidonias,* type *Sterna surinamensis* Gmel.). Boie, Isis, 5, 563, 1822 (*Hydrochelidon,* type *Sterna nigra,* L.).

Black-fronted Tern. Tara

Chlidonias albostriata

The Black-fronted Tern was discovered in Queen Charlotte Sound during Cook's second voyage. It was next collected about 1840 by Mr. P. Earl who found it breeding



Lily A. Daff

BLACK-FRONTED TERN

near Waikouaiti in Otago. The first investigator of its nesting habits was T. H. Potts, who published his observations in 1870.

Adult. Top and sides of head and nape jet black, bordered below by a line of white. Upper and lower tail coverts white. Remainder of plumage grey, darker on the upper surface; the first primary with blackish margin to outer web. Bill reddish orange, yellow at tip. Iris black. Feet reddish orange, claws dark brown. Bill 25-28, wing 240-260, tail 107-115, tarsus 15-17, mid toe 22-25 mm. In winter the forehead and crown are greyish white mottled with black. *Immature.* Crown and nape greyish brown mottled with black; black in front of and behind the eye. Upper surface darker than in the adult; wing coverts scapulars and inner secondaries blackish brown, darker towards the end and margined with yellowish; rump white; tail feathers blackish brown towards the end and narrowly margined with white. Throat, foreneck and under tail coverts white, rest of under surface grey. Bill blackish, reddish at base. Face reddish orange. *Nestling* covered with long down; upper surface fulvous grey blotched with black; throat fulvous brown; rest of under surface white.

Eggs. Clutch two, ovoid, sharp-pointed, dark stone colour with large light and dark brown blotches all over. 38 x 29.5, 41.6 x 28.8, 42.4 x 28.6 mm.

Status. In its general pattern of coloration the Black-fronted Tern resembles the Whiskered Tern (*C. hybrida*) of Europe and Asia, but the slaty black under surface and white throat as well as the wine red bill and feet of the Whiskered Tern sufficiently distinguish it from our species. The Black-fronted Tern is easily separated from the White-winged Black Tern which, with the exception of the wings, rump and tail, is entirely black.

Distribution. North, South and Stewart Islands. In the North Island it is not common but has been recorded from the west coast of Auckland from Pouto to Te Henga; Manukau and Waitemata Harbours; Bay of Plenty from Mount Maunganui to Whakatane; Taupo, Karioi and Waiouru; Ngaruroro and Tukituki River mouths; Wairoa, west coast of Wellington from Rangitikei River mouth to Paraparaumu; Kapiti Island; Palliser Bay and South Wairarapa. In the northern half of the island most records are for the winter months. In the southern half considerable numbers have been reported from Tukituki River mouth (October), Karioi (December), Wairarapa (April), Waikanae (March to July), and Palliser Spit (June). In the South Island, the Black-fronted Tern is found from the Chetwode Islands to Foveaux Strait. It nests at the mouth of the Wairau River, but its main breeding stations are in Canterbury and eastern Otago. Stewart Island: Paterson Inlet. Recorded from The Snares by Guthrie-Smith and from the Chatham Islands by H. O. Forbes.

Ecology. The Black-fronted Tern is found along the coast and also inland on the river beds and adjacent country. It is generally seen in small flocks though after the breeding season large numbers collect together especially at their roosting places on shingle banks in the river beds. There is in winter a general movement from the high country towards the coast and, according to E. F. Stead, during the winter months this tern may be found in flocks from the river gorges to the sea. The birds found in the North Island are obviously mainly winter migrants from the South Island where only the species is known to breed. Possibly a breeding place will be found in the central volcanic plateau south or east of Mount Ruapehu. Sibson states that the birds that visit Auckland are mostly juvenile.

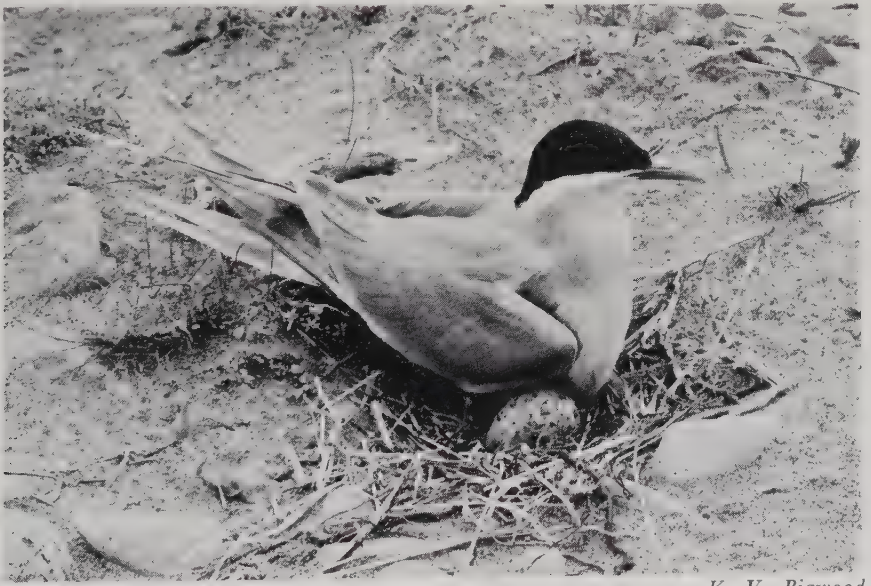
The Black-fronted Tern has decreased in numbers with the progress of European settlement, the occupation of its breeding grounds being the main cause.

Food. The Black-fronted Tern feeds mainly on insects though fish and lizards also form a portion of its diet. It catches moths and other insects on the wing and has developed a habit of following the plough and picking up the grubs which it exposes. It also visits pastures and crops seeking insects and is thus a valuable friend of the agriculturalist.

According to Stead the Black-fronted Tern takes fish on the coast by diving on them from a height, and in rivers it occasionally takes whitebait, silveries, bullies and trout. The same observer says: "Often a whole flock will feed on insects at a height of perhaps a hundred feet. Sometimes I have watched such a flock, the individual members of which were catching from six to fifteen insects a minute, nearly always rising to take their prey. I put this down to the fact that they would see the insect best against the sky."

Nesting. The Black-fronted Tern breeds in small colonies on the shingly river beds of Canterbury and Otago. The nest is merely a hollow in the shingle and is generally placed in a position where large boulders protect it from the north-west wind. The two eggs resemble somewhat in colour their surroundings. The young birds also harmonize with the shingle and from their habit of squatting down and keeping still are difficult to detect. The parent birds pluckily defend their nests, darting down at the intruder and uttering a harsh cry as they swoop past his head.

Guthrie-Smith noted the Black-fronted Tern associating for breeding with Black-billed Gulls, each keeping to its own quarters. Stead states "The birds collect on a suitable shingle bank in September and begin to mate. By the beginning of October they are selecting nesting sites and building, a procedure that takes about a fortnight, though most of this time is spent in play; for the making of the nest, which consists of a shallow scratching or even a natural



Okuku River, Canterbury *K. V. Bigwood*

BLACK-FRONTED TERN

depression among the stones, with perhaps a dozen or so short bits of twig around it, could easily be achieved in an hour at most. In the ordinary course of events, egg-laying in Canterbury begins in the second week in October, but I have known it to start earlier."

References.—Gray, Zool., Erebus and Terror, Birds, 190, col. pl., 1845 (*Hydrochelidon albostriata,* Waikouaiti). Wagler, Isis, 1831, p. 1223 (*S. antarctica*). Finsch, Jour. f. Orn., 1870. Buller, Birds N.Z., 283, 1872; 2nd ed., 2, 70, col. pl., 1888. Stead, Life Hist. N.Z. Birds, 25, 1932. Guthrie-Smith. Sorr. Joys N.Z. Nat., 121, 1936. Sibson, N.Z. Bird Notes, 3, 10, 1948.

White-winged Marsh Tern

Chlidonias leucoptera

This species which is widely dispersed in the northern hemisphere is generally regarded as a winter visitor only south of the tropics. It has, however, visited Western Australia in large numbers including birds in full breeding plumage, while in New Zealand two birds were shot on the Waihopai River, Marlborough, in December, 1868, in full breeding plumage, and Stead in 1927 stated that it is an almost regular visitor to Canterbury in the summer and has nested there.

Adult—Summer plumage. Head, neck and upper back glossy black, coverts on the carpal joint white; remainder of wing grey, the outer primaries greyish black; back and rump greyish black; upper tail coverts and tail white. Under surface black, lower abdomen white. Bill red. Feet orange-red. Bill 23-28, wing 203-208, tail 70-80, tarsus 20, mid toe 25 mm. *Adult—Winter plumage.* Differs from summer plumage in forehead, back of neck and under surface being white; back of head and nape dark brown mottled with whitish; upper back dark brownish grey; rump, upper tail coverts and tail grey. Bill black. *Immature.* Similar to adult in winter but upper surface mottled with brown; tail darker grey; upper tail coverts white. *Nestling.* Upper surface brownish red with black blotches. Lores and round the eye white. Chin white; throat dusky brown; rest of under surface pale buff.

Eggs. Clutch three, pale stone to buff-brown with dark and light brown blotches, 33 x 24.5 mm.

Distribution. Manukau Harbour, Firth of Thames, Waikanae, Collingwood, Waihopai River, Waipara River, Lake Ellesmere, Rakaia River mouth, Otautau.

Central and Southern Europe, Northern Africa, Central Asia to China ranging in winter to South Africa, Southern Asia and Australia. Occasional visitor to Northern Europe. Accidental in United States, Barbadoes and New Zealand.

Habits. The White-winged Marsh Tern is in the northern hemisphere an inhabitant of lakes and swamps, and only occasionally visits the coast. It feeds mainly on insects. Its nest is made of reeds and is placed in marshes.

References.—Temminck, Man. Orn., 483, 1815 (*Sterna leucoptera,* Mediterranean). Buller, Birds N.Z., 287, 1873; 2nd ed., 2, 77, 1888. Sibson, Notornis, 6, 43, 1954. Fleming, Notornis, 6, 69, 1955.

GENUS HYDROPROGNE

Bill stout and deep, culmen arched. Tail short, less than one-third length of wing, outer feathers longest, pointed.

Distinguished from the other terns and from the noddies by its large size, stout and deep bill and short tail with pointed feathers. A single species found in all parts of the world except South America and Polynesia.

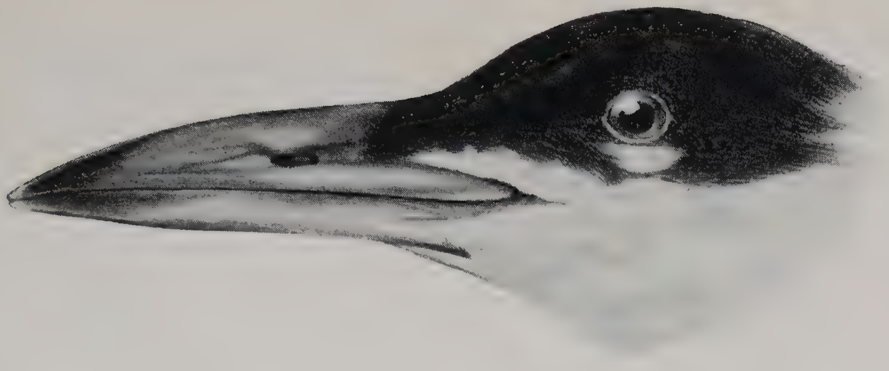
Reference.—Kaup, Skizz. Ent. Gesch. Nat. Syst. 91, 1829 (*Hydroprogne,* type *Sterna caspia* Pallas.).

Caspian Tern. Tara-nui

Hydroprogne caspia

The name of the Caspian Tern crept rather unostentatiously into the lists of New Zealand birds. It appears in Ellman's list in 1861, Gray's in 1862 and Buller's in 1865 without comment. Potts described its breeding habits at Lake Ellesmere in 1870.

Adult. Forehead and upper part of head



Lily A. Daff

CASPIAN TERN

black, a white line below the eye; remainder of upper surface pale grey, upper tail coverts white. Under surface white. Bill red, blackish near the tip which is yellow. Iris black. Feet brownish black, claws black. Bill 65-75, wing 400-420, tail 140-160, tarsus 44-50, mid toe 38-42 mm. In winter, the black plumage of the head is spotted with white. *Immature.* Differs from the adult in the top of the head being streaked with black and buffy white; upper surface spotted with brown, the feathers margined with buffy white. Bill pale orange. Feet blackish brown. *Nestling.* Upper surface pale buff mottled with brown except on the head, under surface whitish.

Eggs. Clutch two or three, ovoid. Stone colour with dark brown spots and blotches, 70 x 43.5, 67.5 x 44, 63 x 45 mm. Raka'a River.

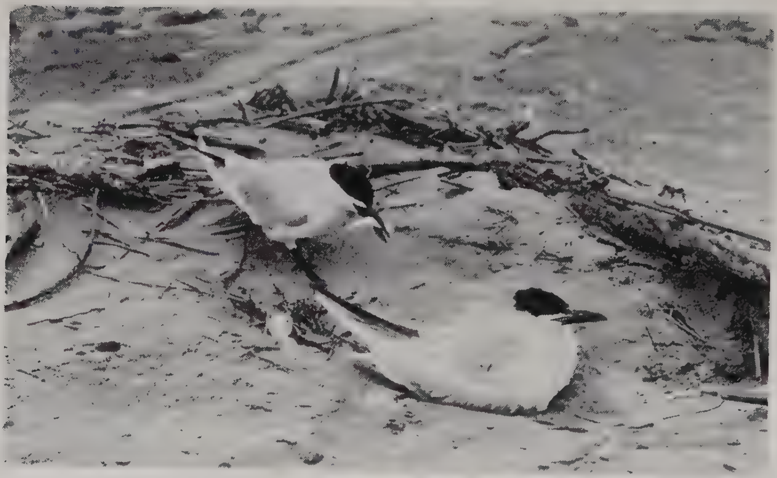
Status. Attempts have been made to divide this species into subspecies but the differences relied on are mainly measurements so small as to be of little significance, for example, typical subspecies, *H. c. caspia,* bill averaging 66 mm., Australian subspecies, *H. c. strennua,* bill 75, New Zealand subspecies, *H. c. oliveri,* bill 71 mm.

Distribution. North and South Islands. Great Barrier Island, Little Barrier Island, Hen Island, Kapiti. Most common in the north of the North Island, but nesting throughout, the most southern breeding colony is in Bluff Harbour. Caspian Terns are occasionally seen on the shore of Foveaux Strait. The principal breeding colonies are north of Auckland, in the Bay of Plenty, at Lake Rotorua, on the east coast of Wellington, Farewell Spit, Wairau Bar, Rakaia River and Washdyke Lagoon.

Europe south of 60° North latitude, Asia (except Japan), Malaya, Australia, Tasmania, Africa, North America from a little beyond the Arctic circle to California and Florida.

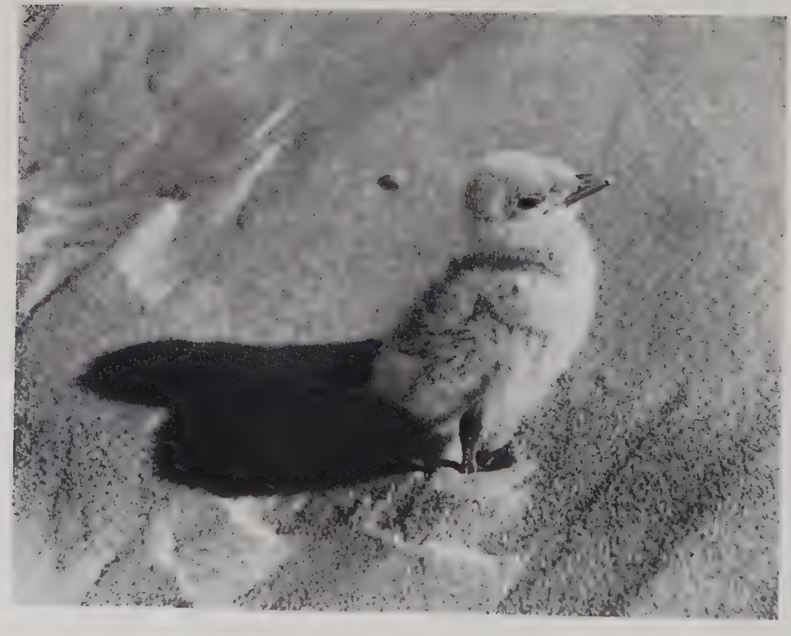
Habitat. The Caspian Tern is usually seen in small numbers along the coast. It enters harbours and may be seen flying over the water fishing, its characteristic attitude being with its head pointing downwards, or it may be observed standing on sandspits and beaches among flocks of terns and gulls. It does not usually go far inland except sometimes for the purpose of breeding when it may ascend a river bed.

Food. Surface-swimming fishes constitute the principal food of the Caspian Tern. Flying along perhaps twenty feet above the water with its beak pointing downwards it suddenly dives on sighting its prey. Closing its wings it takes a plunge without, however, immersing itself for more than a second. Caspian Terns watched by W. Sanderson at Whangarei fed almost entirely on piper (pipefish), but a few flounders and herring (yellow-eye mullet) were also taken. The



Porangahau *H. Guthrie-Smith*

CASPIAN TERN



G. A. Buddle

CASPIAN TERN CHICK

beaks are broken off the piper before they are fed to the chicks. Shrimps and minnows are also included in the diet of the Caspian Tern. In fresh waters such as Lake Rotorua and the Hutt River. The Caspian Tern is known to have taken young trout.

Voice. The note of the Caspian Tern is a very harsh grating sound which it utters at intervals while on the wing. Guthrie-Smith notes that it can emit the most harsh of screams while carrying a fish in its bill. Another note of the Caspian Tern has been described as a peevish whistling call.

Nesting. Open shingle beds and sandy beaches are selected by the Caspian Tern for breeding sites. Usually they are near the sea but sometimes these birds will travel a considerable distance inland to breed on a river bed. The nest consists merely of a hollow in the sand or shingle. Guthrie-Smith states that the nest is composed of sea wrack and flood debris, but his photographs show very little that appears to have been added by the birds to the hollow they have made in the sand. Two or rarely three sparsely spotted stone coloured eggs are laid during September, October or November. Different colonies, even in proximity, may have different laying dates. Thus S. D. Potter records at Mangawai, 170 pairs nesting in two groups, one with eggs on October 22nd, and the other with eggs on November 24th. The chicks are hatched from the end of October to early in December, but both eggs and chicks, perhaps belonging to second broods, may be found in January. On the coast the Caspian Tern not infrequently selects for nesting sand and shingle banks that are within the area swept by storms, or, on the river beds of the Canterbury Plains, shingle banks that are liable to be flooded. Consequently whole colonies are sometimes destroyed but if the eggs have been laid early in the season the birds will prepare another nest and lay again. Guthrie-Smith watched a small colony at Porangahau and found that both sexes share the work of incubation and that the female quits the nest to be fed. On the Rakaia River Caspian Terns breed in close proximity to White-fronted Terns and Black-billed Gulls. Black-backed Gulls, which are not far away, prey on the eggs and chicks of the Caspian Tern.

References.—Pallas, Nov. Comm. Acad. Petr., 14, 582, 1770 (*Sterna caspia,* Caspian Sea). Buller, Birds N.Z., 279, 1873; 2nd ed., 2. 73 1888. Guthrie-Smith, Bird Life, 1, 1925. Buddle, Bird Secrets, 54, 1951.

GENUS STERNA

Bill slender, compressed, straight or very slightly arched. Tail long, more than half length of wing, outer feathers longest, sharp-pointed. Tarsus less than middle toe and claw.

Distinguished from Hydroprogne by the slender bill and long outer rectrices, and from Chlidonias by the longer bill and longer tail with sharp-pointed feathers.

A cosmopolitan genus of about thirty species.

Key to New Zealand Species

Forehead black to base of culmen.
  Outer web of tail feathers pale grey .... *S. vittata*
  Outer web of tail feathers deep grey .... *S. macrura*
Forehead white.
  Lores white.
    Bill yellow.
      Head crested. Wing 360 mm. .... *S. bergii*
      Head not crested. Wing 200 mm. .... *S. nereis*
    Bill black .... *S. striata*
  Lores black .... *S. fuscata*

References.—Linne, Syst. Nat., 10th ed., 137, 1758 (*Sterna,* type *S. hirundo*). Wagler, Isis, 277, 1832 (*Onychoprion,* type *S. fuscata* L.). Boie, Isis, 563, 1822 (*Sternula,* type *S. albifrons* Vroeg.).

Crested Tern

Sterna bergii cristata

Although this species is widely dispersed in the tropical and temperate portions of the Indian and Pacific Oceans, except the American side, it is a rare visitor to the

New Zealand region. A young male was shot by R. S. Bell at Denham Bay, Raoul Island, on April 1st, 1910, and a bird was found by H. R. McKenzie washed up at Spirits Bay in March, 1951.

Adult. Forehead white; crown and nape black, the feathers elongated, forming a chest, frequently with white feathers intermixed. Upper surface behind the neck ashy grey, paler on the tail; primaries with white wedge on inner web; secondaries tipped with white; outermost pair of tail feathers almost white. Sides of face, neck all round and under surface white. Bill yellow with greenish base. Iris brown. Feet black. Bill 65, wing 350-360, tail 180-190, tarsus 28-32, mid toe 36 mm. In winter, the crown is usually white. *Immature.* Forehead and top of head white streaked with brownish black; mantle mottled with black and buffish white; primaries dark grey; tail dark grey tipped with white; under surface white, the throat and neck streaked with brown. *Nestling.* White to yellowish brown, a few black spots on the upper surface.

Eggs. Clutch one, stone colour with blotches and wavy lines of dark and light sepia or purplish brown, 61 x 43, 62 x 42 mm. Tasmania. Littler states that there are two eggs in a clutch.

Distribution. Kermadec Islands. Spirits Bay.

Australia, Tasmania, Malaya. Pacific Ocean from Japan eastward to Hawaii and Southward to Fiji. Other subspecies in Indian Ocean.

Habits. The Crested Tern feeds on fish which it catches by diving from aloft without, however, immersing itself very much. It breeds in densely packed communities on the islands of the Great Barrier Reef. MacGillivray describes a colony in which on a patch of sand twelve feet by seven feet he counted sixty-five eggs, one to each nest which is at most a hollow in the sand.

References.- Lichtenstein Verz. Zool. Mus. Berlin, 80, 1823 (*S. bergii,* Cape of Good Hope). Mathews, Birds Austr., 2, 340, col. pl., 1912.

Arctic Tern

Sterna macrura

The Arctic Tern breeds in high northern latitudes and winters further south, some specimens crossing the equator and spending the southern summer in the Antarctic pack ice. The first specimen to be obtained in New Zealand, a bird in winter plumage, was shot by Mr. A. C. O'Connor at the mouth of the Waikanae River in December, 1929. Subsequently specimens were obtained from the Waimakariri River mouth, 1939, and the Auckland Islands, 1943.

Adult—Summer plumage. Top of head, nape and lores black; a white band along each side of the head under the black; upper surface light grey; upper tail coverts and most of tail white; the outer web of outer tail feathers deep grey; outer primary with outer web dark grey, inner webs of primaries white with stripe of grey next the shaft. Under surface light grey, paler on the throat and white on the axillaries, under wing coverts and under tail coverts. Bill carmine tipped with blackish. Iris dark brown. Feet red. Bill 29-40, wing 260-290, tail 150-200, tarsus 15-17, mid toe 21-23 mm. In winter, the forehead, crown and anterior part of lores are white, the crown streaked with black; under surface white. *Immature.* Similar to adult in winter but wings and tail as in juvenal. *Juvenal.* Forehead and crown greyish margined with black; back, scapulars and wings pale grey mottled with buff and brown; quills as in adult; rump and upper tail coverts white; tail white, the outer webs of feathers deep grey or slate colour. Under surface white, sides of breast brownish. Bill reddish, tip blackish. Feet reddish. *Nestling.* Forehead, lores and throat blackish; upper parts buff or pale grey spotted with black; under surface white.

Eggs. Clutch two or three, pale olive, buff or brown spotted and blotched with brown and drab, 40.2 x 30, 42 x 30, 44 x 30.2 mm.

Status. Distinguished from *S. vittata* by the narrower grey line on the inner web of the outer primaries, and the deep grey on the outer web of the outer tail feathers.

Distribution. Five occurrences in New Zealand. Kaipara Heads. Waikanae. Waimakariri River mouth. Auckland Islands. Macquarie Island.

Breeds in Arctic countries southward to the British Isles and Massachusetts in the Atlantic and British Columbia in the Pacific. In the northern winter migrating southwards as far as the Antarctic pack ice.

Habits. The Arctic Tern breeds "as far north as it can find land." It nests generally in lowland regions among salt marshes or bare islands along the coast or inland in river valleys or even in high mountain valleys. The nest is merely a hollow in sand, gravel or moss. The birds arrive in their summer quarters in April, May and June. The eggs are laid in June and July, and the incubation period is 22 days. The southward migration takes place in August and September.

References.—Naumann, Isis, col. 1847, 1819 (*S. macrura,* Schleswig). Murphy, Ocean. Birds S. Amer., 2, 1099, 1936. Falla, N.Z. Jour. Sci. Tech., 12, 27, 1930. Downes, Emu, 52, 306, 1952.

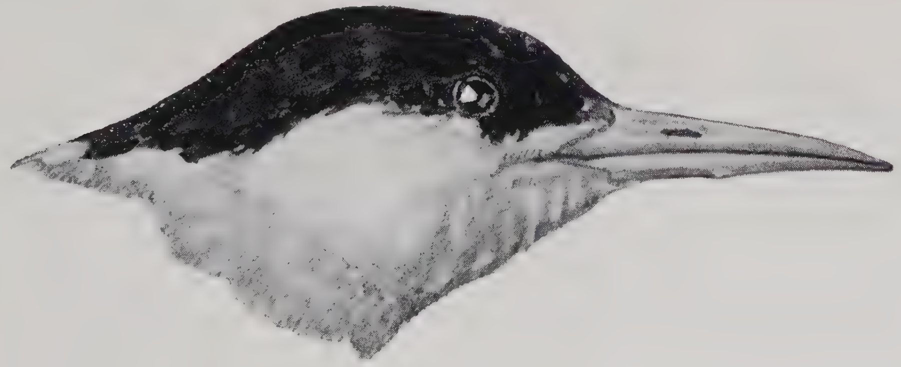
Antarctic Tern

Sterna vittata bethunei

The Antarctic Tern was first collected on Kerguelen Island and was described by Gmelin in 1789. In the New Zealand region it was first observed by A. Hamilton at Macquarie Island in 1894 and the following year was collected by Bethune at the Bounty Islands. It has since been found breeding on all the subantarctic islands of New Zealand.

Adult. Forehead, lores, crown and nape black; a broad streak of white from the gape under each eye to the nape. Upper surface pale grey, quills darker, the outer webs of the outermost blackish; upper tail coverts and tail white, only the outer webs of the tail feathers being pale grey. Under surface greyish white, under tail coverts white. Bill coral red. Iris dark brown. Feet arterial red. Bill 32-38, wing 250-278, tail 120-142, tarsus 17-21, mid toe 22-27 mm. In *winter,* April to November, the forehead and crown are white. Bill and feet red to blackish red. *Immature.* The juvenal moults into the first winter plumage which resembles the adult except for the lores, forehead and top of head being white; sides and back of crown black. Bill and feet blackish red. *Juvenal.* Top of head grey mottled with black; upper surface barred pale buff and black; tip of wing feathers and tail feathers also barred. Throat and breast greyish flecked with brown; abdomen white. Bill and feet blackish red. *Nestling.* Buffy, spotted on the head and neck all round with blackish; upper surface blotched with brown; abdomen white.

Eggs. Clutch one (Snares Island) or two (Auckland Islands), ovoid, slightly pointed



E. H. Atkinson

ANTARCTIC TERN

at one end, brownish stone to olive stone with irregular dark and light brown blotches all over but usually with a concentration in a band at the larger end. 42.6 x 33.5, 43.2 x 32, 46.4 x 33.4 mm. Campbell Island. 40.8 x 31.6, 45.2 x 31.6 mm. Enderby Island.

Status. Relying on juvenal plumage Murphy points out that the southern terns *hirundinacea, vittata* and *virgata* agree in coloration to form a group differing from the northern terns. Five subspecies of the Antarctic Tern are admitted by Murphy: of these the New Zealand subspecies, *S. v. bethunei,* is "light in hue, generally resembling *tristanensis,* but the tail is markedly and consistently shorter and the feet apparently smaller than in the latter race."

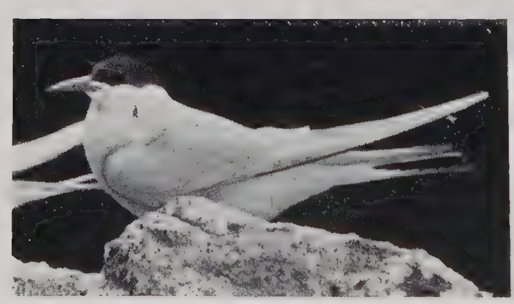
Distribution. Breeds on Big South Cape Island, Solomon Island and the Snares, Auckland, Campbell, Antipodes, Bounty and Macquarie Islands. Apparently not moving far from its breeding quarters as so far, except for a doubtful record from the Chatham Islands, none has been detected near the main islands of New Zealand.

In its breeding range this is the most southern of terns. It breeds in West Antarctica (*S. v. gaini*); South Georgia, South Orkneys (*S. v. georgiae*); Tristan da Cunha, Gough Island, St. Paul Island (*S. v. tristanensis*); Kerguelen (*S. v. vittata*); and the New Zealand region as far as Macquarie Island (*S. v. bethunei*).

Habitat. The Antarctic Tern in its various subspecies ranges from the coast of the Antarctic continent to S. lat. 36°. Its breeding range lies within the Antarctic and Subantarctic temperature zones of ocean waters. The New Zealand subspecies is not known north of the Snares Island in S. lat. 47° and its southernmost breeding place is Macquarie Island, S. lat. 56°. At the Bounty Islands in April, 1927, I saw this tern carrying small fishes to ledges on the cliffs where evidently there were young birds. Ainsworth, speaking of this species on Macquarie Island, states that it remains throughout the year, though no nests were found. "They flit about over the water close to the shore, every now and then dipping down picking up morsels and keeping up a constant shrill squeaking."

Food. On Campbell Island Sorensen found the food of terns to be cuttlefish, crustacea and small fishes. He saw terns diving from twenty to thirty feet and emerging each time with a small fish which was swallowed whilst on the wing.

Nesting. E. F. Stead has placed on record an account of the breeding habits of the Antarctic Tern at the Snares Islands in the following words: "Antarctic Tern nested in considerable numbers around the island. While we were anchored at the foot of the southern cliffs, prior to landing, we watched a colony of at least twenty nests some thirty feet above sea level, among tufts of *Poa astoni.* On the south side of the landing there were eight nests from ten to twenty feet above sea level, and on prominent rocky headlands nearby, from one to five pairs of birds were breeding, at elevations up to 150 feet. The nests I saw were all shallow scratchings in a tuft of *Poa astoni,* lined with blades of this grass and in one case the nest was overhung by a small veronica. This may have been some protection against skuas, for in a situation where skuas were very numerous, the nests of a colony of red-billed gulls (*Larus scopulinus*) were all completely underneath veronicas. In all the Antarctic tern nests we saw there was only one egg or young bird. That this tern has a prolonged breeding season is proved by our



Snares Island *C. A. Fleming*
ANTARCTIC TERN

finding fledged young almost ready to fly, and also fresh eggs. I saw three nests being built and a bird carrying grass in its bill to a fourth. It may be that the Antarctic tern raises two broods a year at Snares, for on a previous visit I had seen birds feeding young on February 1.

"On narrow ridges with precipitous sides on the north coast of the island were two young terns, the one almost ready to fly, the other slightly smaller. They were being fed at frequent intervals by their parents on small, rather attenuated and not very silvery fish between two and three inches long." Stead visited the Snares in December, 1947.

Eggs have been found in the Campbell and Auckland Islands from the end of November to the end of January, and young birds from the end of December. Fleming saw a young bird in flight on Campbell Island on February 16th.

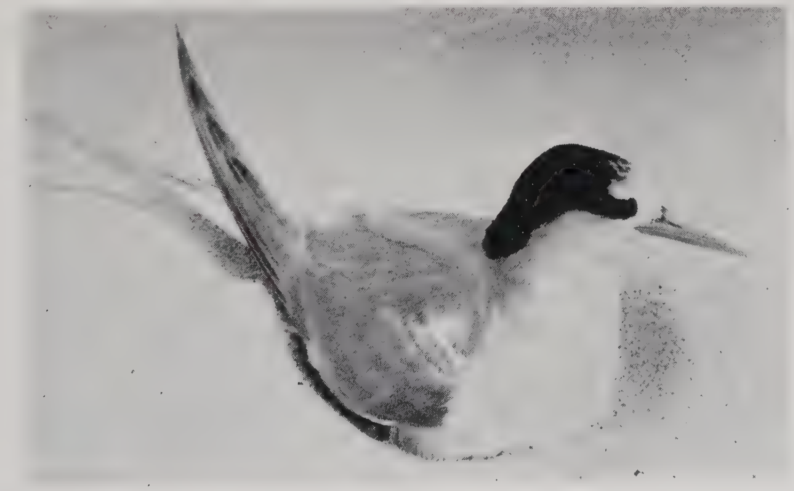
According to Sorensen the Antarctic Terns at Campbell Island always nest close to the sea. In one locality he observed their nests low down on slopes of almost precipitous cliffs. "All terns' nests," he says, "seem to to be situated on top of rocks, usually high ones, and in crevices filled with a growth of *Tillaea moschata.* In most of the nesting situations this plant seems to be the only one found. The nest itself is merely a depression rounded in the growing plant and no extra material of any kind is added." Describing the feeding of young terns Sorensen says: "The adult dived many times and fed the chick several times. Food was transferred when the birds alighted on the water. After the transfer both birds took flight immediately, the chick swallowing the fish in flight."

References.—Gmelin, Syst. Nat., 609, 1789 (*S. vittata,* Kerguelen Island). Buller, Trans. N.Z. Inst., 28, 348, 1896 (*S. bethunei,* Bounty Is.). Mathews, Suppl. Birds Norf. Lord Howe, 107, col. pl., 1936. Falla, B.A.N.Z.A.R.E., ser. B, 2, 260, 1937 (*S. v. macquariensis*). Murphy, Amer. Mus. Nov., 977, 11, 1938. Stead, N.Z. Bird Notes, 3, 74, 1948.

Fairy Tern. Tara-iti

Sterna nereis

The Fairy Tern was first discovered in Bass Strait whence Gould described it in 1843. Potts first noticed it about 1869 on the Rakaia River bed not far below the gorge, where it was breeding. He notes, however, that there were then in the Canterbury Museum two specimens from Canterbury. Being new to Potts, he suggested the name *alba* for it should it prove to be undescribed, but Hutton, who had a marvellous



Pakiri *G. J. H. Moon*

FAIRY TERN

aptitude for tracking down species, listed it in his "Catalogue" as *Sterna nereis,* and Buller in the first edition of his *Birds of New Zealand* recorded it as tolerably common.

Adult. Forehead white; spot in front of each eye, crown of head and nape black; rump, upper tail coverts and tail white; rest of upper surface pale grey. Under surface white. Bill orange. Iris black. Feet orange. Bill 27-34, wing 170-200, tail 70-76, tarsus 15-18, mid toe 18 mm. In winter, the crown of the head is white mottled with black. *Juvenal.* Forehead and crown greyish white mottled with brownish black; a crescent of greyish black encircles the occiput; upper parts silvery grey mottled with white, many of the feathers dark brown near the tip; smaller wing coverts greyish brown; under surface white. Bill and feet reddish brown. *Nestling.* Above buff spotted and lined with black; below white.

Eggs. Clutch two, ovoid, pale stone with small scattered light and dark brown blotches, 35.8 x 26.4, 34.5 x 25.5 mm. Rangitata Gorge.

Status. Similar to the northern *S. albifrons* but paler above, less black in front of eye and the bill not tipped with black.

Distribution. North and South Islands, along the coast. Formerly common in Marlborough and Canterbury. Now rare everywhere but single or few pairs known to breed in several localities in the North Island, mostly north of Auckland. Districts where the Fairy Tern has recently been observed: Pakiri, Whangaroa, Whangarei, Ruakaka, Mangawhai, Kaipara, Manukau Harbour, Firth of Thames, Raglan, Tauranga, Rangitikei, Waikanae, Porangahau, Wairau Bar, Lake Ellesmere.

Coasts of Western and Southern Australia, Tasmania, New Caledonia.

Habits. The Fairy Tern frequents the coasts usually in pairs. Formerly it followed the courses of the great rivers of the eastern portion of the South Island for some distance, and Buller recorded seeing a pair on Papaitonga Lake in the Wellington Province. It feeds on small fishes which it picks up from the surface of the water, splashing in at frequent intervals. Formerly it bred on shingly river beds but now it is known to breed only on the coast. A nest found at Porangahau by Guthrie-Smith was placed on a shell bank between two colonies of White-fronted Terns which gave it complete protection from marauding gulls and harriers. According to Guthrie-Smith the nest was surrounded by coloured shells brought by the terns to match the colour of their eggs. The eggs are laid on the bare ground. They have been found from November until early January. Miss Noelle Macdonald informs me that in the Pakiri-Mangawhai area the Fairy Terns flock together after the young are able to fly and then are not seen for about three months. They return to the breeding ground about August.

References.—Gould, Proc. Zool. Soc., 1842, p. 140, 1843 (*Sternula nereis,* Bass Strait). Buller, Birds N.Z., 285, 1873; 2nd ed., 2, 75, 1888. Guthrie-Smith, Sorrows Joys N.Z. Nat., 118, 1936.

White-fronted Tern. Tara

Sterna striata

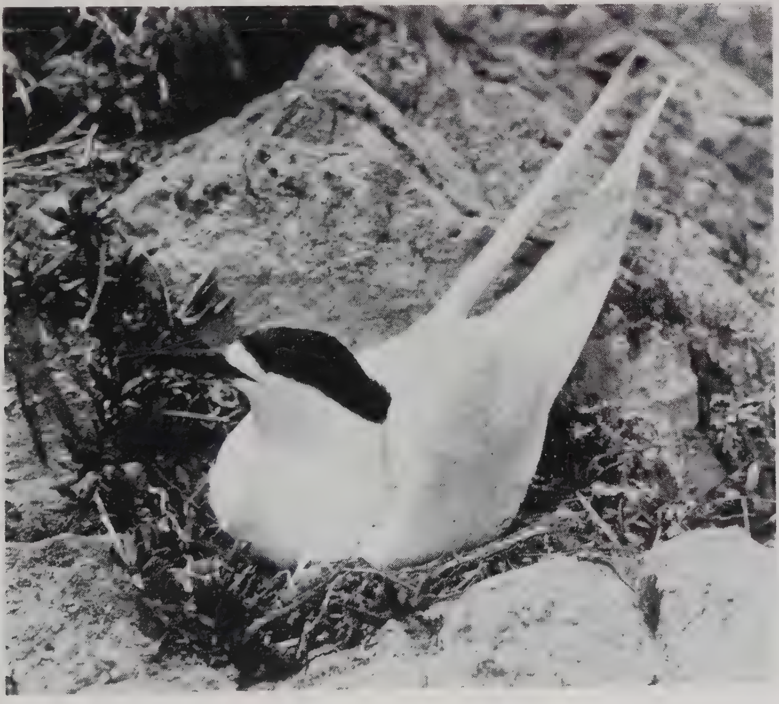
Sir Joseph Banks collected an immature specimen of the White-fronted Tern in New Zealand during Cook's first voyage, and from a drawing made by Parkinson, Latham described his "Striated Tern." The species was again collected during Cook's third voyage and a drawing made by Ellis. This drawing Latham used to illustrate his description. Gmelin merely Latinized Latham's name for his specific name. The species seems next to have been noticed when the American Exploring Expedition visited the Bay of Islands in 1840 and Peale, the naturalist on board the *Vincennes,* described it as congregating in large flocks.

Adult. Forehead and lores white; crown and nape black, rest of upper surface pale grey; outer web of first primary brownish black. Under surface white, suffused with pink (which is evanescent). Bill black. Iris brown. Feet reddish brown. Bill 40-43, wing 280-295, tail 175-185, tarsus 20-21, mid toe 25-28 mm. The *winter* plumage is similar to that of the summer except that there is more white on the forehead and the crown is mottled. *Juvenal.* Top of head and nape greyish black mottled with buff. Back, scapulars and wing coverts buffy white or grey barred with black; marginal wing coverts white, within these they are greyish black. Quills light grey, outer web of outer primary brownish black. Tail feathers pale grey tipped with black and buff. Under surface white. *Nestling.* Upper surface grey or buffy white spotted with black; under surface white. The general colour of the upper surface varies from almost white to dark grey or even dark brown, and the dark spots may be absent.

Eggs. Clutch one or two, ovoid, very variable in colour, perhaps the commonest colour being greenish stone with light and dark brown blotches all over. Other ground colours are dark stone, greenish white, yellowish brown, light brown, pinkish white and, rarely, bluish white or pale red. The blotches also vary in colour sometimes in correspondence with the ground colour, for instance reddish eggs have reddish brown blotches. 45.5 x 34, 46.5 x 35, 43.5 x 32.5 mm. Rakaia River.

Distribution. Three Kings Islands, not breeding. North and South Islands and adjacent islands including the Poor Knights, Little and Great Barrier Islands, Mokohinau, Hen Island, Mayor Island, White Island, Motumau (Bay of Plenty), Kapiti, Codfish and Solanders. Stewart Island. Chatham Islands. Auckland Islands. Inland it has occurred at Lake Rotorua and Lake Taupo. Straggler to the Snares, Campbell and Macquarie Islands.

Australian coast from South Australia to southern Queensland. East coast of Tasmania. The occurrence of the White-fronted Tern in Australia has been carefully investigated by Hindwood who finds that the terns



Kapiti Island *A. S. Wilkinson*

WHITE-FRONTED TERN

are present every year from May to November. Most of the birds are immature and there is no reliable record of the species breeding in Australia.

Ecology. This species is very abundant all along the coast. It associates in large flocks and is to be seen following the shoals of fishes or sitting facing the wind on sand banks and beaches often in company with gulls. It is also occasionally seen inland on riverbeds and lakes. When in flight it always attracts attention by its jerky movements rising up and down in unison with the flaps of its long, pointed wings. This habit has earned for it the title of sea-swallow by which it is not infrequently known.

On the Rakaia River bed very large breeding colonies are found in close proximity to smaller colonies of Black-billed Gulls and Caspian Terns. Black-backed Gulls are usually established nearby and prey on the young and eggs of the terns which, however, often succeed in chasing the gulls away. The Harrier is more easily frightened away than the Black-backed Gull. Stead once found a stoat established in a colony of terns with its burrow full of eggs and young terns. Guthrie-Smith says that on Stewart Island he has known thousands of terns' eggs to have been devoured in one or two nights and he supposed that it was done by rats. When returning to its nest from a fishing expedition a tern is likely to be attacked by Arctic Skuas, Black-backed Gulls and Red-billed Gulls which harass it until it drops its fish which the attacker then catches before it reaches the water.

Food. Small fishes, especially those that congregate near the surface in shoals, form the principal food of the White-fronted Tern. In the southern part of New Zealand this species associates with the Sooty Shearwater in following the shoals of fish, and there are generally far more shearwaters than terns. The terns hover above the water dipping at frequent intervals, while the shearwaters sweep round in wide circles diving in when over the shoal. In the Auckland district terns and gannets follow the shoals of small fish which kahawai and kingfish, working from below, force to the surface. Such sights as a patch of turbulent water caused by multitudes of little fishes trying to avoid the thrusts of kahawai and kingfish and the

Lake Ellesmere *K. V. Bigwood*

WHITE-FRONTED TERN

excited flocks of terns above them are familiar sights in the Hauraki Gulf in summer time. The terns work from near the surface of the water and dart down and pick up their prey which, attacked from above and below, lose many of their numbers. Gannets also take the opportunity of fishing on these occasions and, plummeting from above, take their fish from just beneath the surface. Fishermen wanting bait troll through these commotions and easily catch a few kahawai. In the Canterbury rivers Stead states that he has occasionally seen terns catch the smolts of quinnat salmon.

Voice. The call of the tern is generally a single sharp whistling note frequently sounded. Andersen has recorded it in musical notation and rendered it as *"tsit, tsit, tsit"* and *"keh, keeahk, keeahk."*

Nesting. The White-fronted Tern breeds in large colonies on shingly river beds and also on rocks on the sea coast. Usually it selects small outlying rocks placing its nests quite close together and within a few feet of the water's edge. The colonies on riverbeds may be only a few feet above the water, and during freshets, perhaps caused by a drying wind melting the snow on the mountains, parts will be flooded. I have seen a large section of a colony so destroyed on the Rakaia riverbed early in December, and Guthrie-Smith records a similar fate to a colony by a salt-water lagoon at Porangahau, Hawke's Bay. On the riverbeds the nests are merely hollows in the shingle or sand, lined with small stones, but on the coastal rocks often quite well-formed nests of stalks of Mesembryanthemum or other maritime plants will be made. Terns begin mating in September. According to Stead a male bird brings to the place where the terns have congregated for breeding a small fish in its bill. "Almost immediately one or more hens will approach him with their necks stretched out, as if asking to be fed, when the cock bird will rise in the air, followed by his admirers, and fly about until only one is following him, when he may settle and give her the fish . . . the initial feeding over, the pair seem to regard themselves as mated, and thereafter indulge in what one might term 'ecstasy flights'." On the Brothers Islands Mr. J. H. Mihell has observed mating terns playing with fish while in flight. One bird would drop a fish and the other catch it in mid air. The first eggs may be laid during the last week in October but most will be laid during the first half of November, and some may be found as late as January. One or two eggs form a clutch and when two are laid it is said that only one chick is reared but I can find no confirmation of this statement. Both parents take part in incubating the eggs the period being about three weeks. The nestlings vary much in colour, some being quite light, almost white, while others are dark grey or brown. All, however, harmonize with the surroundings. The young are helpless for two or three weeks after hatching and they are fed by the parents for some time after leaving the nest. The parent birds defend their eggs and young with great bravery. They remain on the nest until the intruder is within a few feet, and then taking flight, swoop down at him, passing within a few inches of his head, at the same time uttering a harsh angry cry. Harriers, ducks or other birds coming too near the breeding colony are immediately set on and chased away.

Terns do not always continue to nest in the same locality. After a few years in one spot they will change their nesting site. Sometimes they will breed in the same place on alternate years. This at least gives time for the nesting grounds to be cleaned up by the weather. In November, 1948, J. M. Cunningham counted 398 nests on Palliser Spit. When I visited this spot in December, 1951, no terns were seen.

References.—Gmelin, Syst. Nat., 609, 1789 (*S. striata*, New Zealand). Gray, Zool. Erebus and Terror, Birds, 19, col. pl., 1845 (*S. frontalis*, New Zealand). Buller, Birds N.Z., 281, 1873; 2nd ed., 2, 68, col. pl., 1888. Guthrie-Smith, Bird Life, 15, 1925. Stead, Life Hist. N.Z. Birds, 32, 1932. Hindwood, Emu, 45, 179, 1946. Buddle, Bird Secrets, 52, 1951. Wilkinson, Kapiti, Bird Sanct., 126, 1952.

Raoul Island *W. L. Wallace*

SOOTY TERN

Sooty Tern

Sterna fuscata

A denizen of all tropical and subtropical seas, the Sooty Tern or Wideawake touches the New Zealand region at the Kermadecs. Here it was first brought to the notice of ornithologists as a result of Cheeseman's visit to the group in search of plants in August, 1887. Although Cheeseman apparently did not see it, his trip being too early in the season, he arranged with Mr. T. Bell, the occupier of the island, to collect skins and eggs. These duly arrived together with a short account of the birds' breeding habits which was published by Cheeseman in 1891.

Adult. Forehead with extensions to above middle of eyes white. Crown of head, nape and a band from the gape through the eye jet black. Hind neck, back, wings and tail sooty black. Marginal wing coverts white. Outer tail feathers white, darker towards the tips of the inner webs. Under surface white shaded with grey on the lower abdomen; lower tail coverts greyish white. Iris black. Bill and feet black with a slightly reddish tinge. Bill 42-45, wing 305-320, tail 180-190, tarsus 22-23, mid toe 27-28 mm. *Immature.* Forehead greyish. Upper surface sooty brown, the feathers of the back, the scapulars, wing coverts and tail coverts edged with buffy white, giving the effect of conspicuous bars across the body and wings. Marginal wing coverts white. Throat greyish; remainder of under surface sooty brown, paler on the abdomen. *Nestling.* Above speckled black and buff, the markings being closer on the head; below and margins of wing whitish with grey throat. Bill brown. Feet flesh coloured. Raoul Island.

Colour varieties. During the breeding season of 1907-1908, two very different colour varieties appeared among the young Wideawakes on Denham Bay Beach, Raoul Island. One was normal except that the right wing had the quill feathers and a large portion of the coverts white; the left wing was similar except that not all the quills were white; feet pink. The other specimen was cream, barred with brown on the upper surface; wings buffy brown, each feather of the coverts tipped with cream; tail buffy brown, tipped with cream. Under surface buffy brown; under tail coverts white, tipped with buff. In this specimen the brown bars on the upper surface are just below the tips of the feathers, that is, where it is darkest in normal young birds, apparently therefore the colour change is due to the loss of brown over the whole surface.

Eggs. Clutch one, ovoid or elongate-ovoid, pinkish white, with light and dark brown blotches chiefly at the larger end. The ground colour varies from white to reddish pink; while the blotches also vary in size, distribution and depth of colour, being as a rule more reddish in those eggs with most red in the ground colour. 58 x 38, 55 x 35.5, 52.5 x 37 mm. Raoul Island.

Status. Belongs to a small group of tropical terns agreeing in having the upper surface dark and a dark line from the gape through the eye. Five or six subspecies have been described but have not been characterized satisfactorily. The typical subspecies (*S. f. fuscata*) was described from the West Indies. That from the Kermadecs has been referred, together with East Australian birds, to a subspecies (*S. f. serratus*) characterized by its long outer tail feathers, larger size and deeper grey on the under surface, but a revision of the species is required to determine whether subspecies should be recognised.

Distribution. The Kermadec Islands where it breeds in large numbers. In New Zealand six occurrences are on record. Te Kuiti, March, 1918. Muriwai, Tauranga and Te Awamutu, February, 1936, after a heavy storm. Manurewa. New Plymouth. Tropical and subtropical seas. Occasionally wanders as far northwards as Maine and the British Isles. In the Pacific it is not abundant on the coast of South America; in the west its southern range includes Lord Howe, Norfolk and the Kermadec Islands.

Habitat. The Wideawake is an ocean-going tern which resorts in large numbers to tropical islands to breed. It is absent from Raoul Island from about the middle of May to the middle of August.

Food. So far as my own observations on Raoul Island go, the food of the Wideawake consists mainly of pelagic cephalopods—spirula and squids. Practically all the recognisable remains in the stomachs examined belonged to these animals.

Voice. The cry of the Wideawake consists of three syllables, the accent being thrown on the first and last. It is not unlike the word "wideawake" spoken in a squeaky voice or with a twang, and is repeated at intervals while the bird is on the wing. A bird with an egg or young chick will often allow itself to be caught and repeats a cry not unlike "go-ak," the latter syllable being most accented. The colony keeps up an incessant chatter during the whole breeding season.

Nesting. Wideawakes are first heard at Raoul Island during the latter half of August but they do not settle on the beach

Raoul Island *T. Iredale*

SOOTY TERNS

until about the middle of September. At first they settle in the evening only but later, during the latter part of October, they settle in the daytime. The first eggs are generally laid during the first week in November, a small colony laying together. Then more groups settle and lay, gradually occupying most of the level ground on the beach. By the end of December, practically all the eggs are laid. No attempt whatever is made to form a nest, the egg being laid on the bare sand or gravel. Incubation takes about 24 days and the young when hatched is covered with speckled black and buff down resembling very much the colour of the beach. Some of the young are ready to fly during the latter part of February and practically all have left the island by the middle of April. They leave in parties, rising off the beach in the evening to a good height and then disappearing to the north. Wideawakes very much dislike rain, and during showers rise up and fly over the bay, deserting both their eggs and young. In this way a good many young perish. Only in the early stages of incubation will the parent remain during rain. The colony is, however, very efficiently protected against harriers. The New Zealand harrier is a regular visitor to Raoul Island but during the period the Wideawakes are there is not allowed to remain. Immediately one appears it is set upon by a number of Wideawakes and so harassed that it returns whence it came.

If a Wideawake trespasses on the nesting territory of another it is greeted with and takes part in a walkabout ceremony. Both birds walk along with swaying heads, wings crossed behind but held out from the body in front, and tail held up. As these shows occur when the young are well fledged they evidently have nothing to do with mating.

References.—Linne, Syst. Nat., 12th ed., 228, 1766 (*S. fuscata,* San Domingo). Gmelin, Syst. Nat., 605, 1789 (*S. fuliginosa,* Atlantic Ocean). Saunders, Cat. Birds Br. Mus., 25, 106, 1896. Iredale, Emu, 10, 8, 1910; Ibis, 1914, 436.

GENUS ANOUS

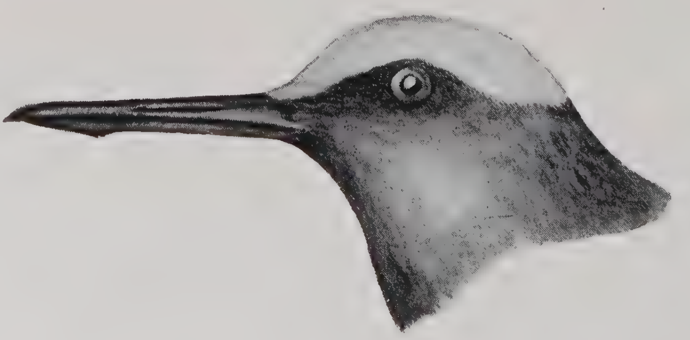
Bill long, straight or slightly arched. Tail emarginate, graduated, third and fourth feathers from outside longest, tips rounded. Toes fully webbed, middle toe and claw shorter than exposed culmen.

Large noddies distinguished by the long bill, rounded tail feathers and fully webbed feet. The fully webbed feet and rounded tail feathers separate them from Gygis, while the long bill and rounded tail feathers serve to distinguish them from Procelsterna. Three species are distributed throughout the tropical seas of the world.

Key to New Zealand Species

Bill stout. Crown grey. Tail black	*A. stolidus*
Bill slender. Crown white. Tail grey	*A. minutus*

References.—Stephens, Shaw's Gen. Zool., 13, 139, 1826 (*Anous,* type *Sterna stolida* L.). Boie, Isis, 10, 980, 1836 (*Megalopterus,* type *Sterna tenuirostris* Temm.).


C. McCann

WHITE-CAPPED NODDY

White-capped Noddy

Anous minutus minutus

This tropical species which includes the Kermadec Islands within its range was first received from Raoul Island in 1890. Credit for this addition to the avifauna of New Zealand is due to Cheeseman who visited the group in 1887 and at whose instigation specimens were collected and forwarded by T. Bell, the occupier of the island.

Adult. Sooty black; wings darkest; forehead and top of head greyish white; tail brownish black; lores, band through eye and throat jet black. Bill black. Feet dark brown. Bill 41-45, wing 225-230, tail 116-120, tarsus 19-23, mid toe 33-35 mm. *Immature.* Dark brown; forehead and crown white; lores black; primaries blackish. *Nestling.* Sooty brown, paler below; top of head grey, whitish on the forehead.

Eggs. Clutch one, ovoid, whitish, with a few dark and light reddish brown blotches chiefly at the larger end, 45.5 x 32, 43 x 29.5 mm. Meyer Island.

Status. The White-capped Noddy is distinguished from the Lesser Noddy (*A. tenuirostris*) of the Indian Ocean by the body colour being much darker, the forehead and crown whiter and the lores being jet black instead of grey.

Five subspecies have been described. The typical subspecies (*A. m. minutus*), which ranges from New Guinea and Queensland to the Tuamotu Archipelago, is the one found breeding at Norfolk and the Kermadec Islands.

Distribution. Kermadec Islands where it breeds on Meyer Island.

Tropical and subtropical Atlantic and Pacific Oceans. The nearest breeding place to New Zealand is Norfolk Island. Visitor to Lord Howe Island.

Nesting. The White-capped Noddy breeds in trees on Meyer Islet near Raoul Island. Most of the nests are in Pisonia trees but ngaio and pohutukawa (*Metrosideros kermadecensis*) trees are also used. The nests are made of seaweed and are rather flat on the top, as would be expected in March when most of the young were fledged. The seaweed more or less plastered itself on to the bare parts of the branches and the nests were almost always located where the branches forked. The single egg is laid in October. On March 1st, when this colony was visited, young and adult birds were plentiful sitting about the trees. There were also in the nests a few young that had not lost all their down.

References.—Boie, Isis, 18a, 1844 (*Anous minutus*, Australia). Mathews and Iredale, Man. Birds Austr., 1, 100, 1921. Guthrie-Smith, Sorrows Joys N.Z. Nat., 165, 1936.

Common Noddy

Anous stolidus

This tropical species is only doubtfully admitted to the New Zealand fauna. There is a specimen in the Reischek collection in Vienna labelled as coming from the east coast of the North Island and dated 1885, while Buller stated that another in the Canterbury Museum was taken on the high seas near New Zealand.

Adult. Crown pale grey, almost white on the forehead; lores black sharply contrasting with the whitish forehead; rest of plumage dark greyish brown; primaries and tail feathers black. Bill black. Iris brown. Feet brownish black. Bill 40-47, wing 260-295, tail 130-154, tarsus 24-25, mid toe 35-39 mm. *Immature.* Differs from the adult in being lighter brown; top of head greyish brown. *Nestling.* Sooty brown, paler on the forehead and abdomen.

Eggs. Ovoid, creamy to pinkish white with brownish red scattered spots and a zone of blotches at the larger end, 56 x 39, 51 x 35.5 mm. Lord Howe Island.

Status. There are eight or nine subspecies. Reischek's specimen is a young bird and the subspecies to which it belongs is indeterminable.

Distribution. Two occurrences. East Coast, North Island (Reischek); "High Seas" (Buller).

Tropical and subtropical seas except the west coast of South America. Straying into the North Atlantic as far as the British Isles. The nearest breeding places to New Zealand are Lord Howe and Norfolk Islands.

Habits. On islets near Lord Howe Island the Common Noddy makes nests of grass and seaweed in dead shrubs on the tops of cliffs. On Nepean Island off Norfolk Island the nests are placed on the ground as there are no trees on the island.

References.—Linne, Syst. Nat., 10th ed., 137, 1758 (*Sterna stolida,* West Indies). Mathews and Iredale, Man. Birds Aust., 1, 102, 1921.

GENUS GYGIS

Bill straight, stout at base, sharp pointed. Tail emarginate, graduated, feathers sharp pointed, second or third from outside longest. Feet with webs deeply indented, middle toe and claw shorter than culmen; hind toe long.

Differs from Anous and Procelsterna in the indented webs; from Anous, further, by the sharp-pointed tail feathers, and from Procelsterna by the middle toe and claw being shorter than the culmen. A single species found throughout the tropical oceans.

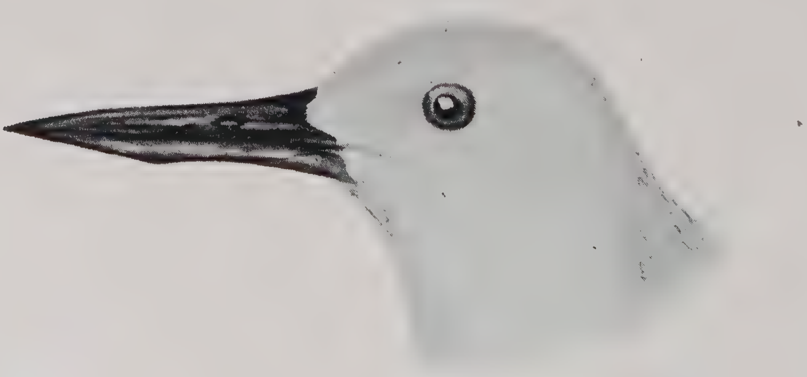
Reference.—Wagler, Isis, 11, 1223, 1832 (*Gygis,* type *Sterna alba,* Sparrm.).

White Tern

Gygis alba royana

The White Tern is one of the tropical noddies that, within the New Zealand region, breeds only at the Kermadecs. Strangely enough a pair of stragglers to New Zealand was taken in 1885 by Andreas Reischek. The specimens are preserved in the Vienna Museum. The discovery of the breeding place of this species on Raoul Island was first put on record by T. F. Cheeseman after his visit to the Kermadecs on a botanical expedition in 1887. Cheeseman received eggs from Raoul Island the following year and was thus enabled correctly to identify the species. Skins were afterwards received and the identification confirmed.

Adult. Ivory white; a narrow black ring round the eye. Shafts of primaries and rectrices brown. Bill black at tip, base blue. Iris black. Feet dark blue, webs yellowish. Bill 38-43, wing 245-258, tail 115-125, tarsus 12-14, mid toe 27-29 mm. Raoul Island. *Immature.* White; black spot in front of eye; feathers of the nape, back, scapulars, inner secondaries and wing coverts tipped with rusty brown. The pattern is variable. *Nestling.* The following description of a Raoul Island nestling in down is supplied by R. S. Bell. General colour greyish brown, much the colour of the egg, with a nearly black



C. McCann

WHITE TERN

Raoul Island *R. S Bell*

WHITE TERN

patch on the top of the head and two broad stripes of the same colour down the back. Breast light grey, abdomen nearly white. Bill very short, lead-grey. Feet light yellowish red. The feet are larger than those of the adult, the toes being long and stout with large hooked claws.

Eggs. Clutch one, elliptical, blunt at both ends, creamy white with close irregular light and dark brown blotches and marks all over. 44.5 x 32.5, 42.5 x 34, 41.5 x 30.5 mm. Raoul Island.

Status. Six subspecies have been described. The Kermadec subspecies (*G. a royana*) is distinguishable by its relatively long bill and wing. To it belong the Norfolk Island breeding birds.

Distribution. Kermadec Islands, breeding sparingly on Raoul Island; Waipu, North Auckland (pair of stragglers). Ettrick (Otago).

Tropical and subtropical oceans, breeding on islands throughout.

Food. According to R. S. Bell, the White Tern when fishing flutters over the water and catches the fish as they jump into the air. This habit has been observed in other parts of the range of this species.

Nesting. According to observations made by R. S. Bell over several years White Terns begin to arrive at Raoul Island early in September. Fresh eggs were found on October 19th, December 22nd and January 10th. Hatching extends from early November until the last week in January. The birds leave the island in March and early April though they have been seen as late as May 7th.

Bell has published a detailed account of the remarkable breeding habits of this species on Raoul or Sunday Island. For the present purpose I cannot do better than quote from Bell's paper.

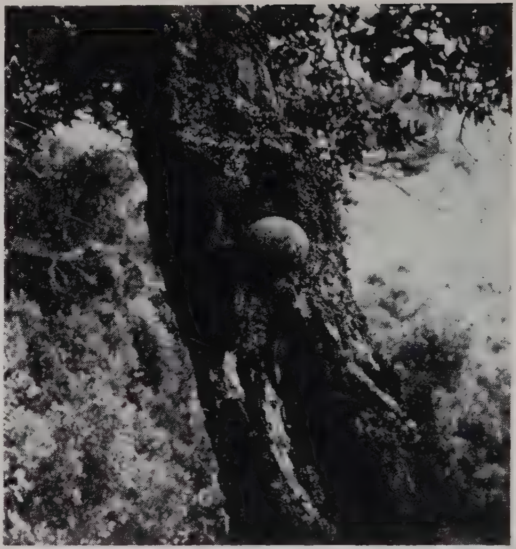
"White Terns begin to arrive at Sunday Island usually about the first week in September, but they are most irregular in their time of arrival and date of laying. For instance, I may mention that a half-fledged young one was found on 29th November, 1908, while during the same season the last new-laid egg was found on 10th January, 1909. The Terns are found in small colonies or in single pairs here and there along the east, south and south-west coasts of the island. The birds arrive, generally, in very

Raoul Island *R. S. Bell*

WHITE TERN FLEDGLING

small numbers at a time, though large flocks, apparently just arrived, have sometimes been seen. They settle almost at once on the trees in which they eventually breed. These trees they apparently occupy during the period of their stay, whether they breed or not. They always perch in them during the heat of the day and camp in them by night.

"White Terns lay one egg only, always on a pohutukawa tree (*Metrosideros kermadecensis*), and as far from the ground as possible. Sometimes they lay on the high lateral branches of a large upright tree, when two or three birds with eggs may be seen close together, but on different branches, for they are not very sociable birds; but more generally they are found singly, near the tops of long, thin, leaning trees, especially those leaning over a steep hillside or deep gully fully exposed to the wind. It is, in fact, on such trees that about three-fourths of the birds lay. They make no nest of any kind, but lay their eggs on the bare stem or branch, wherever there is a little flat place or any inequality that will keep the egg from rolling off. They almost always lay on the main stem of the leaning trees, and rarely where it is less than four or five inches in diameter, though I have on three or four occasions seen an egg on a stem which was not more than about three inches thick. The usual place for birds to lay on is a damaged place on the stem of a tree. These damaged places have the appearance of being caused by stones falling from the cliffs above. In time these stricken places become surrounded by a slightly raised ring of young wood or bark, so that the whole looks not unlike a miniature volcanic crater or a small funnel-shaped pit, with usually, though not always, a slightly raised rim. Somewhat similar places may be formed by dead branches dropping off, leaving a sort of socket. Such places are very common on pohutukawa trees, are no doubt formed in various ways, and are the chosen laying places of about four-fifths of the White Terns. I have sometimes watched the birds at work on these places. They stand on the edge of the selected place (or pit, as I call it) and work round sideways, advancing the right foot first and scratching at the edge of the pit with the left. When they have worked round five or six times they stop, take a step or two backwards, and carefully examine what they have done, picking up with their bills any bits of loose bark they may have scratched off and casting them away. When the egg is hatched, one of the parent birds (probably the male) stays by the young for a week or ten days apparently never leaving it for a moment, while the other brings minute fish and feeds the young one. The little fish are held crosswise, placed head to tail, in the bird's bill. Rarely fewer than two fish are brought at once, but sometimes as many as four. The bird must, therefore, hold one fish in its bill while catching another.



Raoul Island *R. S. Bell*

WHITE TERN EGG ON BRANCH

"The young cling to the bark of their home-branch most tenaciously if any attempt is made to handle them; indeed, if they get a good grip with both feet I believe it would be well-nigh impossible to pull them away without dislocating their legs, for their feet are armed each with three large hooked claws. These grip the wood at the three points of a triangle, so that the more they are pulled the tighter they hold.

"The young bird grows very quickly, and soon becomes feathered; but a remarkable point about them is that they can fly while they are largely covered with down, and long before the pinion feathers are full grown. As soon as they are fully feathered they go out fishing with their parents during the daytime, but always return to their birthplace to camp at night."

References.—Sparrman, Mus. Carls., 1, No. 11, 1786 (*Sterna alba,* Ascension Id.). Bell, Emu, 12, 26, 1912. Mathews, Birds Austr., 2, 433, 1912 (*Gygis alba royana,* Sunday Island).

Genus Procelsterna

Bill weak, sharp pointed, culmen slightly arched. Tail emarginate, graduated, second feathers from outside longest, feathers sharp pointed. Toes fully webbed, middle toe and claw longer than culmen.

Small birds distinguished by their short weak bills, long toes, and sharp-pointed tail feathers: this combination of characters serving to distinguish them from the other noddies. Two species found in the tropical (*P. cerulea*) and south subtropical (*P. albivita*) Pacific Ocean.

Reference.—Lafresnaye, Mag. Zool., 1842, pl. 29 (*Procelsterna,* type *P. cerulea* Bennet).

Grey Noddy

Procelsterna albivitta albivitta

The Grey Noddy, whose domain is the subtropical South Pacific, was described by Gould in 1846 from a specimen said to have come from Lord Howe Island. Gould's name *cinerea* is not now accepted as it had previously been used for another species. The Grey Noddy was collected at Raoul Island by MacGillivray, surgeon of H.M.S. *Herald,* when that vessel surveyed the Kermadecs in 1854, and later by Cheeseman in 1887 when he visited the group on a botanical quest.

Adult. Head greyish white; upper surface and under tail coverts ash grey, darker on the wings; ring round eye, black in front, white behind. Under surface white. Bill black. Feet black with lemon-yellow webs. Bill 26-30, wing 200-210, tail 100-110, tarsus 22-25, mid toe 30 mm. *Immature.* Dark slaty grey, the wings darker and the primaries blackish. *Nestling.* Pale grey, whitish below.

Eggs. Clutch one, ovoid, creamy white with small dark and light brown blotches scattered all over, 43 x 29.5, 42 x 28, 40.5 x 28 mm. Meyer Island.

Status. Distinguished from *P. cerulea* by its larger size, paler colour and white under wing coverts. A subspecies is defined for each of the three principal breeding areas of this species: the Western Pacific subspecies (*P. a. albivitta*) is a large pale form.

Distribution. Kermadec Islands, breeding on Raoul Island, Meyer Islet, Macauley Island, Curtis Island and French Rock. Accidental in New Zealand; three occurrences. Cape Maria van Diemen; Waipu (North Auckland). Off Cape Karikari. Doubtless Bay, sight record.

The South Pacific Ocean, tropical to temperate. Breeding at Lord Howe, Norfolk, Kermadec and the Friendly Islands (*P. a. albivitta*); Henderson and Easter Island (*P. a. skottsbergi*); and St. Ambrose Island, Chile (*P. a. imitatrix*).

P. a. albivitta accidental in eastern Australia.

Habits. The Grey Noddy breeds on all the islands of the Kermadec Group. It lays its single egg in October on a ledge of a cliff, no attempt being made to form a nest. On Meyer Islet these birds were exceedingly confiding. They were sitting on the rocks everywhere and allowed us to approach within a few feet. They seemed to be more curious than alarmed and kept up continuously a kind of purring note like "cror-r-r-r." Small red crustacea have been found in the stomachs of Grey Noddies taken at Lord Howe Island.

References.—Gould, Proc. Zool. Soc., 1845, 104, 1846 (*Anous cinereus,* Lord Howe Id.). Bonaparte, Compt. Rend., 42, 773, 1856 (*Procelsterna albivitta,* new name for *Anous cinereus,* Gould, not Haldeman). Mathews and Iredale, Man. Birds Austr., 1, 103, 1921.

ORDER GRUIFORMES

CRANES

Tall birds with long bills, necks and legs. The skull is like that of the rails in the nostrils not being separated by a bony partition and the maxillo-palatines free from one another. In these features the cranes are quite different from the herons which look like them externally. Young born covered with down and able to run in a few hours.

Genus Grus

Bill straight, nasal grooves more than half the length. Bare skin on crown, sides of head and throat.

Ten species widely distributed in both eastern and western hemispheres.

Reference.—Pallas, Misc. Zool., 66, 1766 (*Grus,* type *Ardea grus* L.).

Australian Crane. Native Companion Brolga

Grus rubicundus

From March to May, 1947, a large bird took up its residence in the Whakatiri Hills near Clevedon. It was seen by many people though not at close quarters. However all descriptions by eye witnesses of its form, colour and flight coincide with the characteristics of the Australian Crane, while a secondary wing feather was found and identified as belonging to the same species.

Adult. General colour silvery grey with pale edgings to the feathers; primaries blackish brown; tail blackish towards the tip. Bare skin on head: crown olive green, fleshy papillae on sides of face and at back of head red, gular pouch olive green. Bill olive green. Iris yellow. Feet dark brown. Bill 152, wing 520, tail 185, tarsus 260, mid toe 90 mm.

Eggs. Clutch two, creamy white sparsely spotted with brown, length 84-91, breadth 60-62 mm. Australia.

Distribution. Whakatiri Hills, near Clevedon, a single bird seen in 1947. It is practically certain that it was a visitor from Australia and returned to that country.

Habits. The bird seen in the Whakatiri Hills exhibited the characteristic habits of the Australian Crane. It flew with its neck held straight out; it flew mainly in circles and often at a great height; and it called almost incessantly when in flight.

In Australia the crane frequents plains and swampy areas. Its food consists of insects and other animals such as rats, frogs and lizards. It also eats leaves and roots of plants. No nest is made, the eggs being laid on the ground, occasionally "rimmed around with pieces of reeds, plants or grass." (Cayley.) When a few birds are together they indulge in dances, the movements being graceful and supposed to be an "expression of general liveliness or excitement."

References.—Perry, Arcana, pt. 6, pl. 22, 1810 (*Ardea rubicunda,* New South Wales). McKenzie and Cunningham, Weekly News (Auckland), 18 July, 1951.

ORDER RALLIFORMES

RAILS, GALLINULES, COOTS

Bill strong, compressed. Wings short, rounded. Feet strong, lower portion of tibia bare, hind toe elevated, toes long. Young covered with down and able to run or swim in a few hours.

Key to Families

No frontal plate .... *Rallidae*
Frontal plate present
  Toes not lobed .... *Gallinulidae*
  Toes lobed .... *Fulicidae*

FAMILY RALLIDAE. RAILS

Bill compressed, nasal groove wide and deep. Wings short, rounded. Tarsi scutellate in front; toes slender and long.

Key to New Zealand Genera

Culmen about equal to tarsus
  Bill straight .... *Rallus*
  Bill decurved .... *Nesolimnas*
Culmen longer than tarsus .... *Cabalus*
Culmen shorter than tarsus
  Wing coverts equal to quills .... *Gallirallus*
  Wing coverts shorter than quills
    Bill decurved, more than three-fourths tarsus; quills barred .... *Nesolimnas*
    Bill straight, less than three-fourths tarsus; quills not barred
      Under wing coverts uniform .... *Crex*
      Under wing coverts barred .... *Porzana*

GENUS RALLUS

Bill rather long, slender to moderately stout, about length of tarsus, upper mandible slightly downcurved at tip, nasal groove long. Wing short, second and third quills longest. Tarsus shorter than middle toe and claw. Toes rather long and slender.

There are about fifteen species distributed over the whole world. Of the two New Zealand species one is representative of the typical section of the genus, the other belongs to the section or subgenus Hypotaenidia characterised by its short stout bill.

Key to Species

Bill slender, breast uniformly grey .... *R. pectoralis*
Bill stout, breast barred black and white .... *R. philippensis*

Reference.—Linne, Syst. Nat. 10th ed. 153, 1758 (*Rallus,* type *R. aquaticus* L.). Reichenbach, Nat. Syst. Vog., 23, 1852 (*Hypotaenidia,* type *Rallus philippensis* L.). Iredale and Mathews, Bull. Br. Orn. Club, 46, 76, 1926 (*Hyporallus,* type *Rallus muelleri* Roths).

Auckland Island Rail

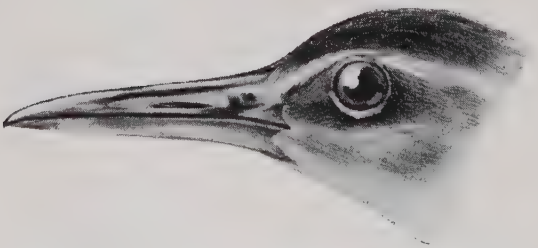
Rallus pectoralis muelleri

Under this heading are included two specimens collected at the Auckland Islands. The first was obtained, about 1864, by Captain Musgrave of the wrecked ship *Grafton.* It was recorded by von Hugel, who received it while he was in New Zealand in 1875, as *Rallus brachypus* (now accepted as a synonym of *R. pectoralis*). It is now in the American Museum of Natural History. The second specimen was forwarded by Baron von Mueller to the Stuttgart Museum some time before 1893 and was described by Lord Rothschild as a new species, *Rallus muelleri.* There is no record as to how Mueller got his specimen. Possibly it also was collected by Musgrave.

Adult. Top of head and hind neck brownish red, faintly striated with black; back and rump chestnut with black centres to the feathers; wings brownish-black with rufous grey edgings to the feathers; tail rufous with indistinct grey bands. Cheeks reddish; centre of throat reddish white; lower throat and breast rufous grey; abdomen, flanks and under tail coverts black, each feather tipped with rufous and with two white bars. Bill 28, wing 84, tail 33, tarsus 28, mid toe 33 mm.

Status. The above description, which is paraphrased from Rothschild's, would almost fit *R. pectoralis,* but all the measurements of Mueller's bird are smaller than those of typical *pectoralis,* the wing being very much shorter. Rothschild notes that the chief distinguishing feature is "the enormous development of the feathers on the back and rump, which have become a huge bunch like that of the Puff-birds (Bucco) of South America." Sharpe says of the same bird, "It is an island form of *H. brachypus,* with the wing coverts elongated and the feathers of the lower back and rump much puffed out, as in the flightless Weka Rails. Its tawny colour distinguishes it at once from *H. brachypus.*" Iredale and Mathews made a new genus, *Hyporallus,* for *R. muelleri* on account of the reduction of the wings and the strengthening of the legs. Von Hugel's specimen is considered by Mathews and Iredale to be undoubtedly *R. pectoralis,* but, until the specimens are again examined, I list both under *muelleri* as it is unlikely that there is, or was, in the Aucklands, two subspecies of *Rallus pectoralis.*

Distribution. Auckland Islands.



Lily A. Daff

BANDED RAIL

References.—Temminck, Pl. color. Ois., 5, 523, 1831 (*R. pectoralis,* New South Wales). Rothschild, Bull. Br. Orn. Club., 1, 40, 1893, and Ibis, 1893, p. 422, also Trans. N.Z. Inst., 26, 180, 1894 (*Rallus muelleri* Auckland Is.). Buller Suppl. Birds N.Z. 1, 42, 1905. Sharpe, Cat. Birds B.M., 23, 330, 1894. Mathews, Suppl. Birds Norf. Lord Howe Is., 77, col. pl., 1936.

Banded Rail. Moho-pereru

Rallus philippensis assimilis

The Banded Rail, which is widely distributed throughout the Malayan archipelago and Australia, is mentioned by Yate in 1835 under the name tatakai though he confuses this bird with the godwit. Apparently Yate knew nothing about birds but merely recorded what he was told and so he made many erroneous statements. In 1839 Heaphy found the Banded Rail plentiful around Wellington, and about 1840 Miss Stone sent a specimen to the British Museum. This Gray named *Rallus assimilis* and gave a brief description of it.

Adult. Top of head brownish olive spotted with dark brown; superciliary streak whitish, continued behind the eye as a pale grey band; back of neck and broad band extending forward below the eye to lores chestnut-red; upper surface of body and wings brownish olive spotted with black and white, the white spots absent over the middle and lower back; primaries dark brown, the two outer ones barred with white, the rest broadly barred with chestnut red; secondaries like inner primaries. Chin greyish white; throat and foreneck dark grey; remainder of under surface and sides of body brownish black, narrowly barred with white; in a band of variable width on the breast and on the under tail coverts the white is replaced by reddish buff. Bill reddish brown. Iris red. Feet brown. Bill 34-40, wing 135-150, tail 63-65, tarsus 38-42, mid toe 50 mm. *Immature.* Similar to the adult but chestnut band from nape to bill paler and less developed. The brown on the breast and under tail coverts pale, almost buff. *Nestling.* Covered with sooty black down. Bill and feet black. *Colour varieties.* A partial albino obtained at Napier is described by Buller. The plumage was normal except for white on the top of head, line over eye, cheeks, throat, patches on breast, neck and shoulders. A variety all grey variegated with cream bands is in the Wanganui Museum.

Eggs. Clutch four to six, broadly elliptic, pale pinkish, with scattered dark reddish brown to pale purplish-grey blotches, chiefly at the larger end, 37 x 29 mm. N. Wairoa. 37.5 x 29.5, 41 x 28 mm. Dome Valley.

Status. The Banded Rail is a polymorphic species, over twenty subspecies being recognised. Its isolation on island groups and sedentary habits on larger areas have no doubt resulted in different forms arising and being preserved. The New Zealand subspecies, *H. p. assimilis,* is distinguished by its dull brown upper surface with little spotting, large bill and long wing coverts and secondaries.

Distribution. Generally distributed throughout the North, South and Stewart Islands, but now rare except north of Auckland; also the Kermadecs (doubtful record), Three Kings, Poor Knights, and Little Barrier Islands.

Beyond New Zealand the species, in its many forms, occurs in the Cocos Keeling Islands, Philippines, Celebes, Sunda Islands, Timor, New Guinea, Pelew Islands, Solomon Islands, New Hebrides, Fiji, Samoa, Tonga, Tahiti, Australia, Tasmania, New Caledonia, Lord Howe Island (said to have been introduced, now extinct), Norfolk Island.

Ecology. Reed covered marshes and mangrove swamps in saltwater inlets and estuaries, as well as freshwater swamps and fernland, are the resorts of the Banded Rail. It comes out to the open mudflats when the tide is low but swiftly takes cover if it scents danger. It runs at great speed but seldom takes to flight. Its contacts with introduced mammals have materially lessened its numbers, mainly through rats eating its eggs. Of twenty-one nests in one area investigated by Guthrie-Smith eighteen had been robbed by rats, the other three were close to human settlement. This to Guthrie-Smith proved that the household cat had actually become the protector of the rails. Another interesting ecological incident is given by Myers and Atkinson, who thought that the elimination of the Banded Rail by rats and weasels in flax swamps had probably been a factor in the development of two species of moth grubs into pests of importance. Buller, writing in 1888, said that the Banded Rail had perceptibly increased because of new favourable conditions which had resulted from the progress of settlement.

Food. Its food consists of small animals such as insects, worms and molluscs and also of berries, seeds and other vegetable matter.

Nesting. Of many nests found by Guthrie-Smith in Petane swamp, Hawke's Bay, all except one were built, preferably over water, in very thick matted layers of rush. The exceptional nest was built in a tall, densely tufted nigger head (*Carex*). The nests were composed entirely of broken, dry, brittle rush stems. Above several of them there evidently had been an attempt at bower making, the growing rushes having been pulled together.

The breeding season extends over several months, young having been found from November to March. Up to six eggs are laid and the chicks leave the nest within two or three hours of hatching.

References.—Linne, Syst. Nat. 12th, ed. 1, 263, 1766. (*Rallus philippensis,* Philippine Is.) Gray, Dieff. Travels N.Z. 2, 179, 1843 (*R. assimilis,* North Id.) Buller, Birds N.Z. 176, col. pl., 1872; 2nd ed., 2, 95, col. pl., 1888. Potts, Trans N.Z. Inst. 4, 202, 1872 (*R. pictus,* Okarito). Guthrie-Smith, Bird Life, 84, 1925.

Macquarie Island Banded Rail

Rallus philippensis macquariensis

Elder, Cormack and Company, during the time they were engaged in sealing at Macquarie Island, brought back alive to New Zealand, in March, 1879, a specimen of the Banded Rail that was then common at the south end of the island. It was an adult female and was presented to the Otago Museum. The following year it was described by Hutton as a new species, *Rallus macquariensis.* Two other specimens, perhaps from the same collection, were later purchased by the British Museum from P. L. Sclater, and these three seem to be all that exist in collections. When Professor J. H. Scott visited the island in 1880 he said that the rail was "not at all uncommon. There seemed to be two varieties—one, slightly the larger, was reddish in colour, the other was black." What the black form was we shall never know, for when A. Hamilton visited the island in 1894, he did not see any rails like the Banded Rail, and as none has since been reported it is presumed that the Macquarie Island form by then had become extinct. Almost certainly this was due to the depredations of rats which at that time were abundant on the island.

Adult female. Generally like *H. p. assimilis* but darker and with few or no white spots showing on the upper surface. Nuchal collar indicated by a wash of rufous shading to brown on the band passing through the eye. Grey superciliary stripe indistinct. Banded markings on sides and flanks less pronounced than in New Zealand birds. Bill and wing shorter than in *R. p. assimilis.* Bill 28-35, wing 117-131, tail 51, tarsus 36-41; mid toe 46 mm.

Status. Although Hutton described the specimen in the Otago Museum as an adult, some of the distinguishing characters he gave are similar to those of the immature stage of the New Zealand form. There is no question, however, about the specimens in the British Museum not being adult and so the Macquarie form of the Banded Rail may be accepted as a good subspecies. Hutton stated that this rail had the bill and legs of *Ocydromus* (i.e., *Gallirallus*), meaning, presumably, that they were stouter than in the New Zealand banded rail.

Distribution. Macquarie Island, common until about 1890, since which time it has not been seen. Three specimens only known to be in museums.

References.—Hutton, Ibis, 1879, 455 (*Rallus macquariensis,* Macquarie Id.). Buller, Birds N.Z., ed. 2, 2, 95, 1888.

GENUS NESOLIMNAS

Bill moderately strong, equal to tarsus, both mandibles curved downwards at tip, nasal grove deep. Wings short, coverts nearly as long as quills. Tarsus shorter than middle toe and claw.

Closely related to section *Hypotaenidia* of *Rallus* from which it differs in the decurved bill and long wing coverts. A single species formerly inhabited the Chatham Islands.

Nesolimnas is a rail that, in its isolation in the Chatham Islands, has departed from the *Hypotaenidia* type to a point midway between that genus and *Gallirallus,* at least as far as modifications towards flightlessness are concerned. Andrews, who founded the genus, said that the form of the beak, the different proportions of the metatarsus and many other osteological characters exclude *Nesolimnas* from *Hypotaenidia* as they also exclude it from *Gallirallus, Nesolimnas* being midway between them.

According to Andrews the skull of *Nesolimnas* is nearer to *Gallirallus* than it is to *Hypotaenidia.* The whole culmen is convex and the tip sharply decurved. The sternum is intermediate between those of *Gallirallus* and *Hypotaenidia.* As in *Gallirallus* the coracoid grooves are separated from one another by a considerable interval. In *Hypotaenidia* they nearly meet in the middle line.

Reference.—Andrews, Nov. Zool. 3, 266, 1896 (*Nesolimnas,* type *Rallus dieffenbachii* Gray).

Dieffenbachs Rail. Moeriki

Nesolimnas dieffenbachi

Although at one time common in the Chatham Islands, only one specimen of Dieffenbachs Rail has been obtained. It was procured by Dieffenbach when he visited the group in 1840, and is now in the British Museum. Dieffenbach said that this rail "was formerly very common, but since cats and dogs have been introduced it has become very scarce. The natives call the bird Meriki, and catch it with nooses. I often heard its shrill voice in the bush, and after much trouble obtained a living specimen."

Adult. Top of head and nape dark rusty brown; line from bill over eye to nape grey; broad band from bill through eye meeting on hind neck chestnut; upper back and wing coverts fulvous brown varied with black and barred and spotted with rufous brown; lower back and rump dark fulvous brown; primaries chestnut with broad bars of brownish black; secondaries brown with chestnut notches. Throat pale grey; foreneck with a band of black barred with white; breast rufous brown barred with black; remainder of under surface black barred with white; under tail coverts black barred with rufous brown. Bill brown, darker at tip. Iris reddish brown. Feet brown. Bill 38, wing 128, tail 82, tarsus 38, mid toe 44.4 mm.

Distribution. Chatham Islands; extinct. Formerly abundant; semi-fossil bones are plentiful.

References.—Gray, Dieff. Travels. N.Z., 2, 197, 1843 (*Rallus dieffenbachii,* Chatham Id.); Zool. Erebus and Terror, Birds, 14, col. pl., 1845. Buller, Birds N.Z., col. pl. 179, 1872; 2nd ed. 2, 121, 1888. Rothschild, Ext. Birds, 125, col. pl., 1907. Andrews, Nov. Zool. 3, 266, 1896 (skeleton).

GENUS CABALUS

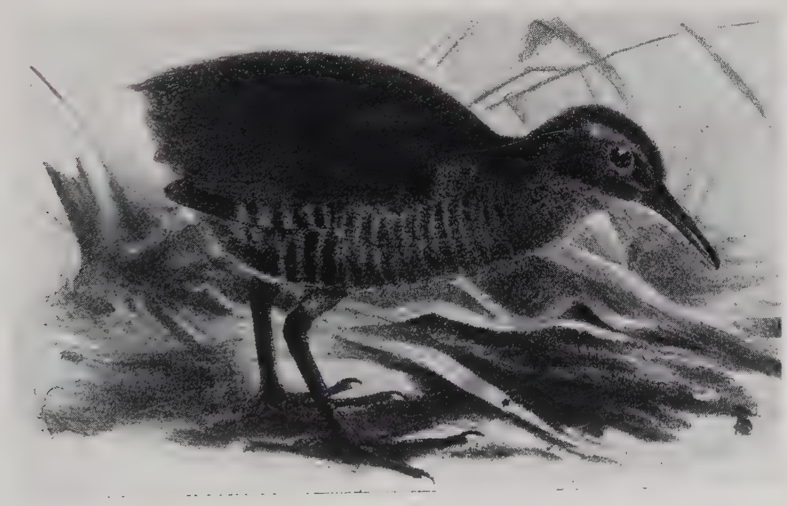
Bill slender, longer than tarsus, the tips of both mandibles distinctly decurved; nasal groove deep, nostrils near middle. Plumage loose, almost complete absence of barbules. Wings short, fourth and fifth quills longest; wing coverts long, quills soft. Tarsus shorter than middle toe and claw.

Distinguished from Rallus by the decurved bill and short wings with long coverts, also by some osteological characters, notably the very reduced sternum, the keel being almost obsolete. It comprises a single species confined to the Chatham Islands.

Reference.—Hutton, Trans. N.Z. Inst. 6, 108, 1874 (*Cabalus,* type *Rallus modestus* Hutt.).

Chatham Island Rail. Matirakahu
Cabalus modestus

This small, brevipinnate rail was discovered by H. H. Travers on Mangere Island, in the Chatham Group, in 1871. Travers collected two specimens and since his visit several more have been obtained. Through the work of collectors in order to gain profit, aided by cats introduced by the



Catalogue Birds British Museum

CHATHAM ISLAND RAIL

settlers, the Chatham Island Rail was exterminated about twenty-five years after it was discovered.

Adult. Upper surface dark vinous brown; quills blackish brown, four outer feathers crossed by triangular markings of fulvous brown; tail dark brown barred with fulvous. Throat grey; rest of under surface dark vinous brown barred with yellowish brown. Bill and feet dark brown. Male: bill 35-38, wing 76-83, tail 40-42, tarsus 25-30, mid toe 35-38 mm. Female: bill 31-32, wing 76-80, tail 38, tarsus 25, mid toe 36 mm. *Nestling* covered with brownish-black down.

Egg. Creamy white with faint pale reddish and purplish spots, 37 x 28 mm.

Distribution. Mangere Island, Chatham Group; now extinct. Formerly also on Chatham Island and Pitt Island.

Habits. The only information concerning the habits of this rail are the following notes by Hawkins who collected a number of specimens. "They nest in holes in the ground, and when the young are hatched they get into fallen hollow trees. They live on insects, principally the sandhoppers (crustacea) which travel into the bush a long way."

References.—Hutton, Ibis, 1872, p. 247 (*Rallus modestus,* Mangere Id.); Ibis, 1873, p. 349; Trans. N.Z. Inst. 6, 108, 1874. Forbes, Ibis, 1883, p. 532. Sharpe, Cat. Birds Br. Mus. 23, 331, col. pl. 1894. Rothschild, Ext. Birds, 127, col. pl. 1907. Buller, Suppl. Birds N.Z. 1, 45, col. pl., 1905.

GENUS CREX

Bill short, decurved at tip, shorter than tarsus, nasal depression wide. Tarsus equal to middle toe and claw.

The short bill and short tarsi with slender toes are characters by which Crex may be recognised. There is a single species distributed over the Palaearctic region.

Reference.—Bechstein, Orn. Tasch. 2, 336, 1803 (*Crex,* type *Rallus crex* L.).

Land Rail

Crex crex

A specimen of the Land Rail said to have been killed near Nelson, about 1865, is the only evidence for the inclusion of this species in the avifauna of New Zealand. It was described by Buller as *Rallus featherstoni* and subsequently ignored by him, but Mathews and Iredale point out that, as the species has been taken in New South Wales, the New Zealand record can be accepted. The species migrates as far south as Cape Province, so that there is nothing improbable in a straggler reaching New Zealand.

Adult. Upper surface brown mottled with black; wing coverts and primaries chestnut; tail feathers reddish brown centred with black; superciliary streak grey; band from lores through eye sandy buff. Chin greyish white; side of face, throat, foreneck and upper breast grey; lower breast and abdomen isabelline; sides of body rufous brown barred with whitish; under tail coverts barred rufous and brown; under wing coverts and axillaries chestnut. Bill and feet brown. Iris hazel. Bill 22, wing 140, tail 57, tarsus 41, mid toe 41 mm. (mmts. N.Z. bird except bill). *Nestling* covered with sooty black down.

Eggs. Clutch seven to ten, pale reddish brown spotted and blotched with reddish brown and grey, 37.3 x 26.7 mm. (av.)

Distribution. Nelson. One occurrence.

Europe and Western Asia, wintering in Africa, as far south as Cape Province. Accidental in Greenland, Atlantic coast of North America and Australia.

Nesting. The nest of the Land Rail, or Corn Crake, is placed among grass in a slight hollow lined with a few leaves and stalks. The eggs are laid during May, June and July, and are incubated entirely by the female. The male, however, is very attentive, bringing food to the sitting bird. The food of the Land Rail consists of insects, worms, snails, lizards and seeds.

References.—Linne, Syst. Nat. 10th ed., 153, 1758 (*Rallus crex,* Sweden). Buller, Essay. Orn. N.Z. (Trans. N.Z. Inst. vol. 1.). 18, 1865 (*R. featherstoni*).

GENUS PORZANA

Bill straight, compressed, the culmen slightly decurved at the tip; nasal depression wide, more than half length of bill. Wings short, first quill short, third longest. Tarsus shorter than middle toe and claw; toes long and slender.

The crakes belonging to this genus are to be recognised by their small size, short bill and uniformly coloured breast and quills, in all of which characters they differ from Rallus. The genus is cosmopolitan and comprises about twelve species.

Key to New Zealand Species

Upper surface uniform dark brown	*P. tabuensis*
Upper surface reddish brown mottled with black and white	*P. pusilla*

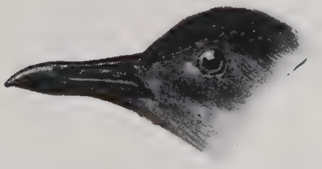
Reference.—Vieillot, Ann. Nouv. Orn. 61, 1816 (*Porzana,* type *Rallus porzana* L.).

Spotless Crake. Puweto

Porzana tabuensis plumbea

The oldest specimen of this subspecies in the British Museum was described by Gray in 1829 as *Crex plumbea.* It has no history, but Mathews is of the opinion that it came from New Zealand. The Spotless Crake is presumably the putoto of Yate, 1835. It was certainly collected by P. Earl about 1840, in Otago, where it was said to frequent swamps and to be very rare. It was, about 1850, collected on Stewart Island by Captain Stokes and in 1871 was brought from the Chatham Islands by H. H. Travers.

Adult. Top of head dark slate suffused with brown; hind neck, back, upper tail coverts and wing coverts chocolate brown, darker on rump and upper tail coverts; marginal coverts white; quills blackish brown, margin of outer web of first primary greyish white; tail black; sides of head and under surface dark slate; chin greyish slate; under wing coverts mottled and barred greyish white and brown; under tail coverts black barred with white. Bill black. Iris and eyelids vermilion. Feet orange, darker at back and on soles, claws brown. Bill 16-20, wing 74-88, tail 42-54, tarsus 25-33, mid toe 32-37 mm. *Nestling.* Covered with black down with blue and green reflections. Bill and feet blackish brown. Iris light yellow. Raoul Island. *Colour variety.* A specimen in the Otago Museum has white on the throat, foreneck and breast.



Lily A. Daff

SPOTLESS CRAKE

Eggs. Clutch three, broadly elliptical, pinkish cream, flecked all over with small light brown marks, 28.5 x 22, 27.5 x 21 mm. Raoul Island. 29.5 x 23, 32.5 x 24, 34.5 x 23.5 mm. Poor Knights. (Buddle.)

Status. The Spotless Crake, throughout its wide range, is remarkably uniform in colouration. Three subspecies are recognised, *P. t. tabuensis,* in Polynesia, New Britain and New Guinea; *P. t. plumbea,* in Australia, Tasmania and New Zealand; and *P. t. richardsoni,* in the Oranje Mountains, New Guinea. The Kermadec form is rather small in body and eggs but hardly separable from the New Zealand subspecies. It has a slightly heavier bill.

Distribution. Kermadec Islands. Three Kings Islands. North, South and Stewart Islands, Poor Knights Islands, Mayor Island, Chatham Islands. Probably not uncommon throughout but seldom seen.

Australia, Tasmania, New Caledonia, Norfolk Island.

Habitat. On Raoul Island the Spotless Crake is found in the forest, but resorts to a raupo swamp to breed. In New Zealand it frequents reed swamps and mangrove swamps. It runs quickly, and swims and dives well, but seldom flies. However, R. S. Bell has seen it fly on several occasions, always with the head and feet down. The longest flight was nine and a half yards.

Poor Knights Islands *G. A. Buddle*

SPOTLESS CRAKE

On the Poor Knights the Spotless Crake breeds in the forest and is to be seen in a small patch of reed swamp at the north end of the south islet. Buddle records a flight of twenty yards.

Food. Insects and crustacea were found in the stomachs of birds taken on Raoul Island. In New Zealand, according to Buller, the food consists of molluscs, insects, seeds and grass. On the Poor Knights Buddle found it feeding on worms, spiders, beetles and insect larvae obtained from the forest floor covering of dead leaves and humus.

Nesting. R. S. Bell studied carefully through a nesting season the breeding habits of the Spotless Crake on Raoul Island, and the following account is taken from notes kindly supplied by him. It resorts chiefly to the raupo swamp in Denham Bay to breed, as usually it is found in the fern and forest nearby. A nest is first made in a clump of fern on land and then the birds repair to the swamp and build a lot more, ten or twenty, all being built at the same time, that is to say, the birds add a little to each nest every day. Finally one is selected to lay in, another is used by the male to roost on and the remainder are left. The nests are built of raupo or grass and placed in clumps of dead raupo about twenty inches above the water. The birds begin to build during September and fresh eggs have been found between the middle of October and the middle of December. The peak laying time is November 10th to 20th. The eggs are laid at intervals of a day. The female apparently does all the work of incubation while the male keeps guard and warns her of danger. Immediately the young are hatched the whole family leaves the swamp and takes possession of the nest previously built on land. In this the young remain continuously for a few days and afterwards roost in it with one of the parents every night. A nest kept under observation by Bell was found to be thus used for over three months, when it was destroyed by heavy rain. The young were then only about half grown.

The nesting habits of the Spotless Crake in New Zealand have been described by G. A. Buddle from observations made on the southern islet of the Poor Knights. He found the crake well distributed over the island in bush and scrub. "The nest is a bulky, clumsy structure 8 or 9 inches in diameter. It is loosely woven and invariably composed entirely of the material—*Microlaena* (bush grass) or sedge as the case may be—in which the nest is built, the lower part of the nest being composed of the stalks, surmounted by a very slightly cupped platform of the finer leaves, on which the eggs are laid. Several very deep cup-shaped nests (unoccupied) were found, totally unlike the usual occupied nests. Possibly these were nests to which the young are removed, or roosting nests as described by Roy Bell . . . on the Kermadecs. The nest may be as much as three feet from the ground, occasionally on the ground, but usually about a foot from it. It is almost invariably screened from outside observation. . . . The clutch is two or three, . . . the earlier clutches were often three and the later ones two. . . . Many nests of the year were found in which we assumed, from their appearance, a clutch had been hatched. On the other hand, a number of unoccupied nests were found, which indicates that laying commences in October and continues until at least early December.

"The young are active within a few hours of hatching. A nest contained three eggs one evening; next morning it was found to be empty. A careful search on the ground beneath the nest revealed the youngsters skilfully concealed beneath dead leaves. . . . Of several nests under observation no sign of the young could be found forty-eight hours after hatching."

References.—Gray, Cuvier's Anim. King. 3, 410, 1829 (*Crex plumbea*). Buller, Birds N.Z. 181, col. pl. 1872; 2nd ed. 2, 101, col. pl. 1888. Mathews and Iredale, Austr. Av. Rec. 2, 114, 1914 (*P. p. oliveri,* Sunday Id.). Buddle, Emu, 41, pp. 63, 130, 1941; Bird Secrets, 28, 1951.

Marsh Crake. Koitareke

Porzana pusilla affinis

The Marsh Crake, which is found in most parts of the Eastern Hemisphere, was first discovered in New Zealand by P. Earl, whose specimen, taken on the banks of the Wanganui River and now in the British Museum, was described by Gray in 1845 in the report of the *Erebus* and *Terror* expedition. Being a small species inhabiting swamps, it is difficult to obtain, and hence there is little to be recorded of its early history. Travers brought a specimen from the Chatham Islands in 1871, but the first time that any number appear to have been collected was in 1881 to 1883, when a cat caught and brought in seventeen specimens from the swamps near Petane.

Adult. Top of head and hind neck tawny brown mottled with black; lower sides of neck and upper wing coverts pale tawny brown, some of the feathers tipped with white; back, rump and long inner secondaries tawny brown blotched with black and varied with white; marginal coverts white; quills olive brown, a narrow white outer border to the first primary, and flecks of white on the outer secondaries; upper tail coverts and tail feathers brownish black with tawny brown margins. Sides of head and under surface from throat to centre of abdomen pale ashy grey, throat paler; lower abdomen, flanks and under tail coverts blackish brown barred with white; under wing coverts brownish grey mottled with white. Bill and feet brownish green. Iris red. Bill 17-18.5, wing 80-85, tail 45-50, tarsus 25-28, mid toe 35-38 mm.

Eggs. Clutch four to eight, oval, glossy, brownish olive, freckled all over with darker, 28 x 19, 27.5 x 17.5 mm. Tasmania.

Status. The New Zealand subspecies, *P. p. affinis,* is one of five into which the species can be divided. The other subspecies have very much more extensive ranges but all are found within the eastern hemisphere.

Distribution. North, South, Stewart, Little Barrier and Chatham Islands. Apparently everywhere rather rare, least so in north

Auckland and Westland. Being of a retiring disposition and living in swampy places the Marsh Crake is not often detected in the localities that it frequents.

The species occurs from Central Europe and Asia eastward to Japan, Africa, Madagascar, Australia and Tasmania.

Habits. The Marsh Crake inhabits both fresh and saltwater swamps and also the marshy banks of rivers. It runs quickly among the vegetation and on floating raupo, and swims well but seldom flies, and then only for a few yards. Its food consists of insects, mollusca and seeds.

The nesting habits of the Marsh Crake in New Zealand do not appear to have been observed. In Australia the nest is described as being made of rushes and aquatic plants loosely woven together and concealed in rushes growing in shallow water. There are two entrances to the nest through the vegetation enclosing it.

Reference.—Pallas, Reise, Rus. Rei. 3, 700, 1776 (*Rallus pusillus,* Siberia). Gray, Zool. Erebus and Terror, Birds, 14, 1845 (*Ortygometra affinis,* Wanganui River). Buller, Birds N.Z. 183, col. pl. 1872; 2nd ed. 2, 103, 1888.

GENUS GALLIRALLUS

Bill strong, compressed, high at base, slightly arched; nasal depression wide, extending more than half length of bill, aperture near its anterior end. Wings very short, the coverts reaching the tips of the quills; quill soft, secondaries lengthened; a spur near the carpel flexure. Tail feathers not rigid. Tarsus strong, shorter than middle toe and claw, hind toe strong, elevated; claws strong.

A genus of large rails with strong bills and feet, and rudimentary wings rendering them incapable of flight. Not closely allied to any other genus. Its nearest ally is perhaps Tricholimnas of Lord Howe Island and New Caledonia and formerly of the Gilbert Islands.

Two species may be defined, both confined to New Zealand.

Key to Species and Subspecies

General colour rufous
  Breast uniform or indistinctly blotched, North Id. .... *G. a. greyi*
  Breast conspicuously blotched with black
    Size larger, South Id. .... *G. a. australis*
    Size smaller, Stewart Id. .... *G. a. scotti*
General colour buff .... *G. hectori*

How many species of Wekas ought to be recognised has always been a debatable point. Actually there are six or perhaps seven forms definable by colour and size. Their general pattern of coloration is the same but differences are found in the amount of black in the feathers and in the colour of the borders to the black centre of the feathers, which may be buff or chestnut. The North Island form can be separated from the others by the amount of grey on the under surface and the absence of spotting on the breast. The breast band may in fact be absent altogether. Its general rufous coloration allies it to the Western South Island Wekas. The South Island forms can be treated as two species, one with chestnut the other with buff edgings to the feathers.

Reference.—Lafresnaye, Rev. Zool. 1841, p. 243 (*Gallirallus,* type *Rallus troglodytes* Gmel.).

North Island Weka

Gallirallus australis greyi

Though the North Island Weka was generally recognised as a distinct species the confusion in the names was not cleared up until the publication of the second edition of Buller's *Birds of New Zealand,* in 1888, when it was dedicated to Sir George Grey. It is, therefore, not easy to trace its early history. It is apparently the pukunui of Yate writing at the Bay of Islands in 1835 and the specimen which Gray, in the report of the birds of the *Erebus* and *Terror* expedition, 1845, described as the young of *Ocydromus australis,* belonged to this subspecies.

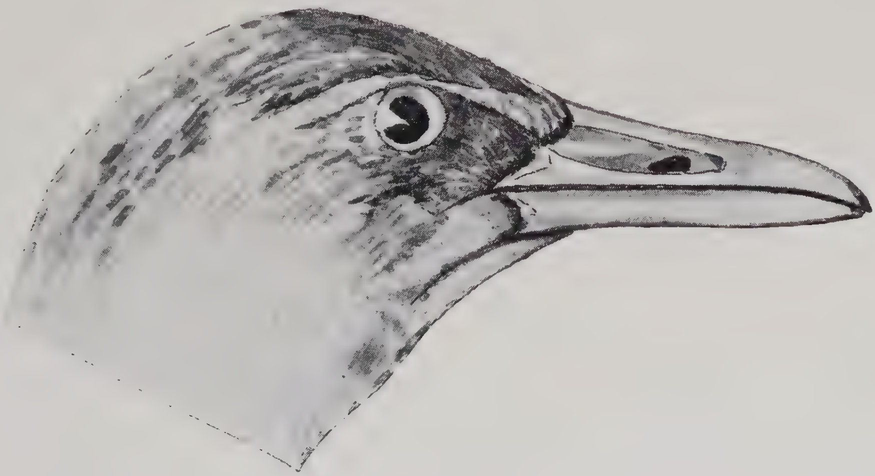
Adult. Upper surface of head, neck, back and wings rufous, darkest on head and neck, spotted on head and neck and blotched elsewhere with black; lores, sides of face, lower back, rump and sides of body rufous brown; quills black banded with rufous brown; tail feathers black edged with rufous. Throat, foreneck, superciliary streak widening behind, lower breast and abdomen slaty grey, brownish on the lower abdomen; a band across the breast rufous brown; under tail coverts black banded with rufous. Bill reddish brown, darker on the ridge. Iris reddish brown. Feet brown. Bill 40-49, wing 165-195, tail 110-125, tarsus 55-70, mid toe 65-76 mm.

The ground colour of the upper surface varies in depth being more reddish in some birds. The rufous pectoral band also varies in extent and sometimes is absent. *Immature.* Upper parts darker and more uniform in colour; under surface brownish grey washed with ferruginous on the upper breast. (Buller.) *Nestling* covered with brownish-black down. Bill dark brown.

Colour varieties. The recorded colour varieties of this subspecies are pale varieties, partial albinos and complete albinos. A specimen from Marton in the Canterbury Museum is pale brown with reddish brown streaks on neck and wings. Partial albinos are of interest as similar ones occur in the South Island, one of them having been described as a distinct species. A specimen from Hawke's Bay is thus described by Buller: "Forehead, fore part of crown, sides of head, and all the under parts pure white; some of the primaries, secondaries, wing coverts and one tail feather white; upper parts normal, the normal colour appearing in a small patch in the middle of the breast, behind the thighs and under the tail." A different kind of partial albino is that described by Buller from the Manawatu district. In this the white feathers were scattered over the whole body, more especially on the crown, back, wings, breast and sides. A pure white weka with a few feathers of normal colour on the back and base of tail was obtained at Mohaka. A specimen in the Auckland Museum is white with normal feathers scattered all over, tail and thighs mostly normal.

Hybrid. Wilkinson states that the wekas on Kapiti Island are authentically reported to be descended from a male from Stewart Island and a female and chick from Waikanae. They are generally like the North Island species, but with redder legs.

Eggs. Clutch four, ovoid, creamy white with scattered brown and light purplish blotches, chiefly at the larger end, 57.5 x



E. H. Atkinson

NORTH ISLAND WEKA

Kapiti Island *Amy Wilkinson*

NORTH ISLAND WEKA

40.5, 60 x 40.5, 61 x 43.2, 63 x 42.5 mm. Wanganui.

Status. Compared with the South Island Wekas there is in the North Island Weka a larger amount of grey on the under surface and the breast band is not spotted. This band may be much reduced or altogether absent, whereas in the southern forms it is always wide and spotted. The ground colour of the feathers of the upper surface is browner than in the South Island wekas.

Distribution. Throughout the North Island; formerly abundant everywhere but now restricted to certain localities both in the forest and the settled districts. Within the last forty years wekas were common in several places in the North Island but disappeared at different times. In Taranaki they are said to have disappeared during the influenza epidemic of 1918. At present they can be said to be common only in the East Cape district and some still persist north of Auckland, though E. T. Frost, in 1946, reported wekas as almost disappeared from all districts north of Whangarei. Both the North Island and Stewart Island wekas were transferred to Kapiti Island.

Ecology. In all districts where the Weka is now found it frequents stations where some kind of cover in the way of plants is found. Its natural habitat is the forest, scrub, swamps or sand dunes, but in the settled districts it takes advantage of hedges, waste gorse or manuka land and other similar places. It quickly adapted itself to European conditions, its curiosity bringing it right up to the homesteads where, it soon learned, there was plenty to eat. During the daytime it usually hides in the scrub, under logs or among rocks, but about sunset it sallies forth and its shrill cry is heard well into the night. If alarmed it quickly darts under cover where it often successfully eludes pursuit even by dogs.

The weka was formerly common throughout the North Island but at the present time is found only in a few places, mainly in the East Cape district and north of Auckland. Its decrease has in the main followed settlement. Thus Heaphy stated that in 1839 it was scarce in the Hutt Valley, but in 1880 it was common. It has now disappeared from that locality. According to Buller there were few wekas in the Kaipara district in 1855. At present it has quite disappeared from the Kaihu Valley but on the east coast at Rodney Point it is quite common. But while the history of the North Island Weka has been mainly one of decreasing numbers, its sudden disappearance from any district may be due to local migrations. However, it has been fairly well established that the weka soon adapted itself to the changed conditions in the settled country and increased, but with the spread of stoats and weasels it decreased.

It has been noticed in the lower Waikato district that the weka and the Brown Duck disappeared about the same time. Now the weka takes many eggs of the Brown Duck during their breeding seasons which more or less coincide in time. Mr. M. E. Fitzgerald is of the opinion that the weka requires egg food for its young and its decrease is due to the decrease in the supply of this kind of food as the ducks have been shot out by Europeans. The eggs of all kinds of native birds that nest on the ground are searched out with a considerable degree of intelligence by the weka. They include pipits, sometimes robins, ducks, pukeko and other swamp birds and the smaller kinds of petrel.

Unbounded curiosity and a propensity to annex anything moveable are the traits ascribed to the weka by bushmen who, unable to stand the annoyance of losing camp property, including such valuables as watches, are inclined to allow their dogs to clear them out from the vicinity of the camp. But such petty annoyance and the habit of taking eggs are the only crimes laid to the weka. Fowls' eggs especially suffer. The nests of wild turkeys in the East Cape district are robbed and it has been said that the cause of the disappearance of pheasants was the marauding propensities of wekas. The North Island Weka is not likely to trouble us for long judging by the rapidity with which the species has disappeared during the last fifty years. Against the wekas' misdeeds must be set the fact that the bird is one of the most entertaining and interesting in the forest, both to the bird lover and the scientist, and that it consumes large quanities of grass grubs and other noxious insects, as well as rats, mice and weasels. By killing these small mammals it acts as protector to other native bird life. It would increase in settled districts could it obtain safe cover, as has been observed near Wanganui and Cape Rodney where gorse protects it, but it is kept in check in most places by dogs, cats and stoats. There is a record, by H. F. Robb, Manutuke, of a weka chasing away an opossum.

Food. Nothing edible comes amiss to the weka. In its native state its principal food is insects, crustacea, worms, lizards, fruits and, if fortunate enough to find the owners off their guard, birds' eggs. It also eats any young birds that it is able to catch. It hunts diligently on the ground in the forest, turning over everything moveable in search of small animals, while in the proper season it eats all small fruit within its reach or that it finds fallen to the ground. These include fuchsia, various species of coprosma and even the snow totara of the subalpine scrub. A good deal of food is found by the weka on the sea shore where it busily searches among the seaweed and driftwood cast up by the waves. Here, besides occasional dead fishes, it finds abundance of small crustacea.

Voice. The call of the weka, which carries a long distance and is heard from early evening through most of the night, is a shrill whistle begun in a low note, continued in a higher one and several times repeated. It is said that the male first calls and before he has finished, the female answers.

Nesting. The weka conceals its nest in various places in the forest or scrub. It may be under a leaning tree trunk, at the base of a tree fern hidden by the dead hanging leaves, under a clump of rushes, in a flax bush or dense patch of fern or manuka. The proximity of an abundant supply of food determines, according to Guthrie-Smith, the site chosen by a weka for its nest, thus he states that if a beast gets bogged or a fat sheep trapped, thus providing a supply of maggots, it is quite worth searching for a nest in the neighbourhood. The nest is generally loosely constructed of dead grass or other grass-like leaves, and the eggs, of which the normal clutch appears to be four, are laid from September to November but sometimes later, even up to June. Though, apparently, the weka usually pairs for life with a single hen, Guthrie-Smith records a case where eight eggs were laid in a nest near which three birds were observed, evidently two hens associating with a single male. Both parents share the duties of incubation.

Maori. The Maori used the weka for food, catching it with snares and, later, after the advent of the Europeans, training dogs for the purpose.

References.—Buller, Birds N.Z. 2nd ed. 2, 105, col. pl. 1888 (*Ocydromus greyi,* North Island); 1st ed., 165, col. pl. 1872; Suppl. 1, 47, 1905. Guthrie-Smith, Birds, Water, Wood, Waste, 60, 1910. Andersen, Bird Song, 199, 1926. Myers, N..Z Jour. Sci. Tech. 6, 76, 1923. Wilkinson, Emu, 26, 252, 1927.

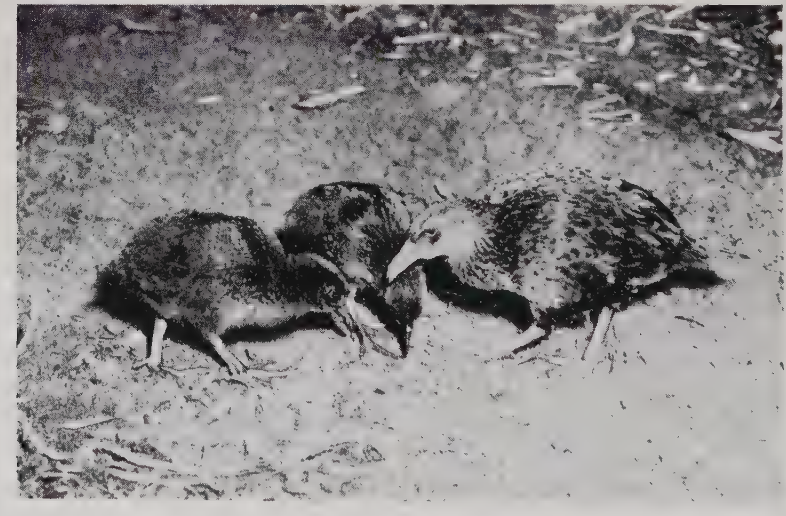
South Island Weka

Gallirallus australis australis

Chestnut Phase

Though the name South Island Woodhen or Weka is adopted for this subspecies, it is absent from a large area of the eastern side of the island, where it is replaced by the Buff Woodhen. Wekas were seen in numbers at Dusky Sound by Captain Cook and his party, and although some of them were black wekas, most of them probably belonged to the chestnut form, for Sparman's description of *Rallus australis* and Gmelin's description of *R. troglodytes* refer to the chestnut form while Latham mentions a specimen in the Leverian Museum as having the upper surface deep chestnut. The South Island Weka was not certainly heard of again until 1850, when Stokes collected a specimen at Milford Sound, and in 1862 Gray described an undoubted example received from P. Earl and said to have been obtained at Dusky Sound.

Adult. Upper surface of head, neck, back and wings rufous blotched with black, the spots being smaller on the head; lores, sides of face, rump and sides of body rufous brown; quills banded black and rufous brown; tail black variegated with rufous brown. Throat, foreneck, superciliary streak widening backwards, and patch on upper abdomen grey; breast rufous spotted with black; lower abdomen rufous brown; under tail coverts and flanks barred with black. Bill reddish brown, dark brown on culmen



Caswell Sound *K. V. Bigwood*

SOUTH ISLAND WEKAS

and at tip. Iris reddish brown. Feet reddish brown, dark brown behind; claws brown. Bill 42-52, wing 175-200, tail 120-140, tarsus 55-70, mid toe 66-70 mm. There is a good deal of variation in the amount of black on the upper surface and also on the breast, some birds showing little or no black on this part. The reddish colour of the plumage also varies somewhat in depth. *Nestling* covered with long dark brown down.

Colour varieties. Included here are forms in which the upper parts are normal with patches of white, and the under surface white with patches of normal. Of these no fewer than six instances are on record, all from the West Coast of the South Island, but the variation in the distribution of the white colour and the fact that a similar form has appeared in the North Island Weka and the Buff Weka shows that it is merely an accidental mutation. Nevertheless one of the specimens from the Westport district has been made the type of a new species, *G. townsoni,* by Mathews and Iredale. A weka recently obtained in south-west Nelson was mostly white, only the hinder part and a few odd feathers being normal.

Eggs. Pinkish white with scattered dark and light brown blotches, 59 x 41.5 mm. Farewell Spit.

Status. Under the name *australis* I have included all the wekas except the Buff Weka, which is definitely distinctive in coloration and so equivalent taxonomically to all the other wekas taken together. These have a general chestnut coloration varying in the amount of grey on the under surface, and each form on the main islands may be given subspecific status. A dark phase is found among the wekas in the Fiordland area and on Stewart Island. These black phases interbreed freely with the chestnut phases and produce birds mostly of intermediate coloration.

Distribution. The northern and western portions of the South Island. Abundant over a large part of its range.

Ecology. Most of the area over which this weka is distributed is forest country, but outside the forest it frequents scrublands and especially the sea shore and edges of lakes and swamps. Its habits are similar to those of the other species. It slinks about and satisfies its curiosity by inspecting everything unusual, all the time keeping as much under cover as possible. As in the case of the North Island Weka the history of the South Island Weka has been one of decrease in numbers in the settled districts, but it is abundant in much of the forest still remaining in the northern and western regions of the South Island.

Food. Wekas living near the sea coast get much of their food from the beach, where, by turning over drift seaweed, they find myriads of sandhoppers. In the forest and scrub they feed on insects, worms, river crayfish, freshwater mussels, the large snail paryphanta, lizards, berries and the eggs and young of ground nesting birds. When they have eaten out one locality they move to another.

Uses. The weka formerly furnished a welcome article of food to the gold diggers and prospectors of the west coast of the South Island. The birds were caught by dogs, and when prepared by smoking, kept for a considerable time. The oil was used for cooking, as an embrocation for bruises and rheumatism, and for other purposes where grease was required. The weka is now enjoying the protection of the law which it well deserves, for it kills rats and mice and devours large numbers of insects. Against the Weka it must be stated that its impudent and inquisitive nature lead it to destroy a certain number of eggs and young of domestic fowls and ducks, and it eats such native birds' eggs as come in its way.

References.—Sparrman, Mus. Carls. No. 14, 1786 (*Rallus australis,* Dusky Sound). Gmelin, Syst. Nat., 713, 1789 (*Rallus troglodytes,* Dusky Sound). Gray, Ibis, 1862 p. 238 (*Ocydromus earli*). Buller, Birds N.Z., 2nd ed., 2, 115, 1888; Suppl. 1, 52, 1905 (*O. earli*). Mathews and Iredale, Ibis, 1914, p. 293 (*G. townsoni*). Guthrie-Smith, Mutton Birds, 152, 1924.

Black Weka. Weka-pango

Gallirallus australis australis.

Black Phase

The Black Weka was discovered at Dusky Sound during Cook's second voyage. The following account of Captain Cook's, of birds he calls "Water or Wood Hens," undoubtedly refers to it. "These last although they are numerous enough here, are so scarce in other parts that I never saw but one. The reason may be that, as they cannot fly, they inhabit the skirts of the woods and feed on the sea beach; and are so very tame or foolish as to stand and stare at us till we knocked them down with a stick. Most of them are of a dirty black or dark brown colour, and eat very well in a pye or fricassee." In 1841, Lafresnaye described a Black Weka from Dusky Sound and in the same locality Hector, in 1862, obtained the specimens on which Buller founded his species *Ocydromus nigricans.*

Adult. Upper surface brownish black, each feather margined with blackish chestnut; quills brownish black with narrow chestnut bars, sometimes broken. Lores and line under eye dark brown; superciliary streak and throat grey tinged with brown; a broad band across the chest rufous, blotched with brownish black; patch on upper abdomen grey washed with brown; remainder of under surface rufous brown, barred on the flanks and under tail coverts with brownish black. Bill dark brown, reddish at the base. Iris reddish-brown. Feet reddish brown, darker behind. Bill 43-51, wing 161-200, tail 117-140, tarsus 55-70, mid toe 64-76 mm. *Nestling* covered with black down.

Eggs. Clutch two or three, ovoid, pinkish white with scattered dark and pale brown blotches chiefly at the larger end, 54 x 39.5 mm. West Coast; 59 x 41, 63.5 x 40 mm. Dusky Sound.

Status. The Black Weka differs from the ordinary South Island Weka in the greater amount of black in its plumage. This shows in the greater proportion of black to chestnut in each feather and in the chestnut colour being darker. The two forms are very closely allied but have different areas of distribution, the Black Weka being found only in the southern part of the range of the chestnut form.

Hybrids. The darkest Black Wekas are very different in appearance from the chestnut ones, but in any locality where both kinds are found, Lake Manapouri and Doubtful Sound, for instance, there are many birds of intermediate phases of plumage. It is obvious that the two kinds freely interbreed and the resulting hybrids show intermediate stages in the amount of blackness in the plumage. A male bird of the black phase paired to a female of the chestnut phase raised a family of two in the camp of the New Zealand-American Fiordland Expedition at Caswell Sound in 1949. The two chicks were dark coloured though not so dark as the dark parent. They are shown with their mother in the photograph reproduced here.

Distribution. South Westland and the western portion of Otago, from the sea coast to Takitimu Mountains, Lake Te Anau and the Southern Alps; abundant. It has been recorded from as far north as Okarito and Lake Brunner. At Caswell Sound the black and the chestnut forms appear to be in about equal numbers.

Habits. The Black Weka inhabits the dense forests of the western portion of Otago from sea level to about 3000 feet altitude. The vegetation comes right down to the water's edge and the weka is often encountered on the river beds, lake shores or sea beaches. Each pair has its own territory, the boundaries of which are respected by other wekas. The male is the chief defender and according to R. Henry, who closely studied these birds in Dusky Sound, if the female gets killed, he soon finds another mate, but if the male is killed, another pair occupies the territory.

Voice. Reischek says that in Dusky Sound the Black Weka comes out from its hiding place in the evening, or on dull days, "when one can hear their melancholy whistle, consisting of three notes, *u, o, e,* especially before bad weather." As heard at Caswell Sound the weka's call is an upward slur, the lowest note having a kind of growl.

Nesting. As the Black Weka is the common kind at Dusky Sound, Henry's account of woodhens in that vicinity is here summarised. Several nests were found. One was in a sheltered dry situation under a flax bush and made of the frayed dead flax leaves. Three is the usual number of eggs laid; the breeding season being August, September and October. Both parents share the duty of incubation, which takes 27 days. The male bird assists assiduously in rearing the young, which remain in hiding while he and his mate search for their food. Henry further states that when the weka chicks were about seven weeks old the mother handed them over to the father and took no more care of them, but built another nest and laid three eggs in it.

References.—Lafresnaye, Rev. Zool. 1841, p. 243 (*Gallirallus brachypterus,* Dusky Sound). Buller, Trans. N.Z. Inst., 1, 111, 1869 (*Ocydromus nigricans,* Dusky Sound). Buller, Birds N.Z., 175, 1873; 2nd ed., 2, 112, col. pl., 1888; Suppl., 1, 61, 1905. Henry, Trans. N.Z. Inst., 30, 279 1898; Flightless Birds N.Z., 7, 1903.

Stewart Island Weka

Gallirallus australis scotti

The early sealers and whalers used this inquisitive bird for food. In 1850 the survey ship *Acheron* visited Stewart Island and Captain Stokes records in his journal of the voyage several living wekas as having been brought on board. They quickly became tame and ran about the deck picking up scraps of food. Captain Stokes said that the weka was fond of human society and that it abounded in the neighbourhood of native villages. Professor Black listed this weka in 1872 and it has been noted by all subsequent visitors.

It is said that after the wreck of the *Grafton* (1864), wekas were released on Auckland Island, but if so they did not survive. An exceedingly successful introduction was achieved when the Stewart Island Weka was taken to Macquarie Island, where it is now everywhere abundant. The recorded introductions are, 1872, by Captain Printz of the *Sarah Pile,* the chestnut phase, and 1879, by Elder, the dark phase. But Buller says that Captain Gilroy, about 1830, took wekas from New Zealand to Macquarie Island.

Adult. The Stewart Island Weka differs from the South Island Weka in its being smaller and in its dark phase not being so black as is the black phase of the South Island Weka. The bird is noticeably smaller though, other than the total length, bill and tail, the differences in the measurements are slight. In colour the chestnut phase is quite similar to that of the South Island Weka. Bill pink, slaty brown on culmen and tip of lower mandible. Iris light chestnut. Feet pink, brownish on hind part of tarsus. Bill 44-46, wing 140-175, tail 111-130, tarsus 51-55, mid toe 56-62 mm.

The black phase has the feathers of the upper surface and breast with large black centres and dark chestnut margins. Throat and abdomen dark brown without distinct black centres to the feathers. The colours of the soft parts are darker than those of the chestnut phase. Falla gives for the Macquarie Island dark form: "Iris red brown; bill brownish vinaceous, darker on ridge; feet dark vinaceous brown." *Nestling.* Black phase: First down short, woolly, greyish black; second down long, thick, blackish brown. (Buller.)

Status. As the black phase of the Stewart Island Weka is not so different from the chestnut phase as the Black Weka is from the South Island Weka, and as the distribution areas of the two phases in Stewart Island are identical the two forms can be treated as a single taxonomic unit. As such it can be separated from the South Island and Black Wekas by its lesser range of colour and its smaller size.

Distribution. Stewart Island, formerly plentiful everywhere, but now only so to the south of Paterson Inlet. On almost all the islets adjacent to Stewart Island, but in several cases these are introductions from Stewart Island, while in a few islands it is suspected that the wekas were introduced from the South Island. Big Solander Island, only the chestnut phase. Macquarie Island, transferred by sealers from Stewart Island. Transferred to Kapiti Island.

Habits. The weka is found from sea level to the uppermost parts of Stewart Island, excepting, says Guthrie-Smith, drifting sands and the saturated peats of the mountain tops. It is probably most abundant along the coast where there is much food to be gathered on the beach. It is quite without fear of man, coming out in the open in search of food within a few feet of him so long as he remains still. It soon gets used to timber milling machinery. According to Mr. R. H. Traill the weka is increasing in numbers in Stewart Island. On Macquarie Island the weka, after its introduction, increased rapidly and eventually overran the whole island. In 1895 Hamilton stated that wekas had multiplied in a most extraordinary way; Ainsworth said that they were very numerous in 1913; and Falla, in 1930, said they were still plentiful. According to Falla wekas have been a factor in the reduction of numbers of burrowing birds on the islands. During his three days ashore he failed to find a single burrow occupied by a petrel.

Food. The weka finds an abundance of food on rocky and sandy beaches. It turns over seaweed and feeds on the sandhoppers which swarm in such places. In the forest it is constantly searching in a similar way, feeding mainly on insects and berries. It hunts for the nests of ground feeding birds and if successful will devour eggs or chicks. Rats and mice are killed and eaten by this weka. On Macquarie Island Ainsworth says that wekas subsist for the most part on the larva of the kelp fly, small fish, and other marine life which they find under stones at low tide.

Voice. Guthrie-Smith compares the call of the Stewart Island Weka with that of the North Island Weka stating that the whistling call of the Stewart Island bird is always uttered very much faster than the more deliberate call of the northern bird. The Stewart Island Weka, continues Guthrie-Smith, also has a much larger range of calls and notes most of which are dissimilar to those of the North Island bird.

Nesting. The Stewart Island Weka hides its nest so well that no one has yet placed on record a description of it or of the measurements of the eggs. Guthrie-Smith states that wekas' nests are built within a few yards of the nests of the nelly. "Besides half-devoured kuaka, all fatty matters ejected by the (nelly) chicks were continuously gleaned from the edges of the nests." On Macquarie Island, November 2nd to 4th, Falla saw several pairs of wekas each with a chick. He thought that the reduced number of chicks in a brood was possibly an adjustment to the overstocked condition of the island in regard to that species. R. H. Traill, however, said of the Stewart Island Wekas: "They have two young in the very early spring, two in midsummer and in late summer two or three and even, on one occasion, four."

Maori. Captain Stokes of the *Acheron*, writing from Stewart Island in May 1850, says the Maoris preserved wekas by opening them down the back, removing the bones, and then cooking them. They were then put in a rimu bag filled up with the fat extracted in cooking. The Maoris used to transfer wekas from Stewart Island to the offlying mutton bird islands for the purpose of providing food during the mutton birding season.

References.—Grant, Bull. Br. Orn. Club, 15, 78, 1905 (*Ocydromus scotti*, Stewart Island); Ibis, 1905, 550. Guthrie-Smith, Mutton Birds, 149, 1914. Falla, B.A.N.Z.A.R.E., ser. B, 2, 274, 1937.

Buff Weka

Gallirallus hectori

The credit of the discovery of this species should probably go to Percy Earl, who about 1844, brought a live specimen to England. Earl stated that a small living bird was the greatest treat that he could give this weka. A description and coloured figure are given

Chatham Island *C. A. Fleming*

BUFF WEKA

by Gray in the report of the *Erebus* and *Terror* expedition under the name *Ocydromus australis.* The Buff Woodhen was next collected by F. Strange about 1850, on the shores of Lyttelton Harbour, and Potts discovered its nests in Canterbury, publishing a description in 1870. A distinctive specific name was not given to the Buff Weka until 1874 when Hutton named it *Ocydromus hectori* from a specimen collected by Mr. Morton in the Eglinton Valley.

Adult. Upper surface yellowish buff longitudinally spotted and blotched with brownish black; on the head the ground colour is tinged with rufous and the spots much smaller; primaries and their long coverts chestnut irregularly and narrowly barred with black, and partly edged with buff; tail feathers rufous with central and lateral black lines and edging of rufous. Superciliary streak and throat light grey, chin paler; lores and band under eye rufous brown; foreneck and breast fulvous obscurely shaded with brown; abdomen ashy brown; sides of body and under tail coverts yellowish brown narrowly barred with brownish black. Bill reddish brown at base, brown on culmen and tip. Iris reddish brown. Feet reddish brown, hinder aspect and claws brown. Bill 50-52, wing 220-225, tail 140-165, tarsus 63-70, mid toe 75-83 mm. *Immature.* Generally lighter in colour with the markings more brown and less distinct. Only on the back do large blotches occur. There is less rufous on the head and the edges of the feathers are buff. Bill and feet paler. Iris dark brown. *Nestling.* At first covered with blackish brown down, later changing to a lighter shade of brown. *Colour varieties.* Several colour varieties of this species have been obtained. Some are pale forms, buff with light reddish brown bars on wings and flanks; others partial albinos, that is, portions of the plumage white, the remainder normal; a third group comprises those birds which are wholly or mainly white or ashy white. A specimen from Nelson which I have examined has the upper parts normal and the lower surface white. It is very similar to the partial albinos of the North and South Island Wekas described above.

Eggs. Clutch four, ovoid, creamy white with scattered brown and pale brown blotches chiefly at the larger end, 58.5 x 40 mm. Waimate; 53.5 x 39 mm. Rangitata; 56 x 40 mm. Ashley Gorge; 64 x 42.5, 65.5 x 42 mm. McDonald Downs.

Status. As a species *G. hectori* is distinguished by the general buff coloration, contrasting with the chestnut of *australis.* Neither the buff nor the dark colour is constant in shade throughout the range of the species. Cream coloured, that is, lighter, forms from mountain districts, have been recognised, while darker birds have been described as a subspecies (*G. h. reischeki*). In the Chatham Island birds the dark markings on the feathers are brown rather than black, the edgings to the feathers are darker than in the mainland form, and there is less rufous on the crown. They accordingly look different from South Island birds. These differences, however, hardly justify dividing the species into subspecies. It would be interesting to know whether the birds on the Chatham Islands have become browner since their introduction in 1905.

Distribution. The eastern portion of the South Island from Marlborough to south Otago; formerly very abundant throughout but now common in certain districts only and entirely absent over large areas. According to Stead the Buff Weka was abundant in Canterbury until 1917.

This species of weka is said to have been in former times common on the Chatham Islands. Possibly it was an introduction by the Maoris, but it became extinct before 1868. In 1905 it was reintroduced from Canterbury, it increased rapidly in numbers, and now is common everywhere. In 1863 Sir George Grey introduced this species to Kawau Island where it increased to such an extent that it soon overran the whole island.

Ecology. The Buff Weka is a characteristic species of the open tussock country of the eastern side of the dividing range of the South Island, ranging from sea level to a height of 6,000 feet or more. It is also encountered in swamps, scrub, forest and rocky ground within its area of distribution.

In districts where the Weka is numerous it has been found to do a considerable amount of harm by robbing ducks' and hens' nests and their young, and by eating low growing fruit, and it is supposed to have checked the establishment of pheasants. It has also caused a considerable amount of annoyance by its insatiable curiosity which leads it to carry off sundry household articles such as spoons, forks, pipes, shoes and even watches. Against its predatory and pilfering propensities must be set the immense amount of good it does by destroying grass grubs, mice, rats and young rabbits. The weka has been a great boon to many bushmen, its flesh forming an abundant and palatable food and its fat useful for the many purposes, medicinal and other, to which oil and grease are put. Though it enjoys the protection of the law it has greatly decreased in numbers, accompanying the progress of settlement, the direct causes being fires, dogs, stoats and weasels.

To this account may be added the observations of C. A. Fleming on the Chatham Islands that to the weka's presence may be attributed the comparative rarity of rats and rabbits, and also a diminution in the numbers of ground nesting birds. He observed that at all mutton bird colonies on the main island numbers of eggs were found on the surface, characteristically pierced by wekas' beaks.

Food. Equally as omnivorous as its relatives, the Buff Weka subsists mainly on insects, worms, crustacea, lizards, birds' eggs and berries, as well as the introduced rats, mice, young rabbits and fallen fruit. W. T. L. Travers states that he has seen a weka drive its beak into an egg, and then, raising its head to a nearly upright position, run into the bush with the impaled egg.

Voice. The shrill call of this weka is, according to W. W. Smith, who was very familiar with these birds, keeping several in captivity, always led off by the female and answered in all directions by both sexes. The same observer states that before rain, its call is more incessant and repeated at shorter intervals.

Nesting. The nest of the Buff Weka is usually placed under tussocks (Poa, Danthonia), nigger heads (Carex), or mountain daisies (Celmisia), or in thick clumps of scrub or fern, or under rocks. It is made of grass, the method of construction being thus described by W. W. Smith: "The grass is placed in a loose heap in the spot selected; the nest is shaped by the bird squatting on the material, and turning round until a hollow is made; it then draws the grass around its body with the under surface of the lower mandible." According to Smith four eggs are laid and take twenty days to incubate. The young leave the nest when three or four days old and follow the parents for about three months. The breeding season is mostly in the spring and summer, but Smith states that eggs and young may be found all the year round.

Maori. The Maori collected large numbers of wekas for food. They employed dogs to run down the birds, which were preserved in their own fat. Single parties would take as many as 2,000 birds in a single hunt. The following account of the Maori method of taking wekas was published by Mr. W. J. Phillipps from information supplied by A. Burrows, an early Canterbury settler. Mr. Burrows "was very interested to watch Maoris catching them by using a weka wing attached to a stick about six feet long and a noose attached to a longer stick. The cry of the weka was made by the fowler using a whistle of flax called a whakapi made from the youngest and finest blades of the flax plant. The bird came to investigate and was caught in the noose."

References.—Gray, Zool. *Erebus* and *Terror*, Birds, 13, 1845 (*O. australis*, adult, col. pl.). Potts, Trans. N.Z. Inst., 3, 100, 1871. Hutton, Trans. N.Z. Inst., 6, 110, 1874 (*Ocydromus hectori*, Eglinton Valley). Buller, Birds N.Z., 170, col. pl. 1872; 2nd ed., 2, pp. 116, 119, col. pl. 1888 (*O. australis*, *O. brachypterus*); Suppl. 1, pp. 58, 60, 1905. Smith, Trans N.Z. Inst. 18, 131, 1886. Iredale, Austr. Av. Rec., 2, 15, 1913 (*G. h. reischeki*). Andersen, Bird Song, 200, 1926 (Nos. 1, 2, 9). Fleming, Emu, 48, 492, 1939.

FAMILY GALLINULIDAE
WATER HENS

Bill deep at base, compressed, the base of the culmen expanding into a frontal shield. Wings rounded. Feet strong, toes long, not webbed.

The frontal shield is well developed in some genera such as Porphyrio and Notornis but it is indistinct in Tribonyx.

Key to New Zealand Genera

Frontal shield well developed
  Secondaries much shorter than primaries .... *Porphyrio*
  Secondaries nearly as long as primaries .... *Notornis*
Frontal shield indistinct .... *Tribonyx*

GENUS PORPHYRIO

Bill short, deep, compressed, nostrils oblong, no nasal depression. Frontal shield large, produced backward over the eyes. Second to fourth quills longest; secondaries much shorter than primaries. Tarsus shorter than middle toe and claw.

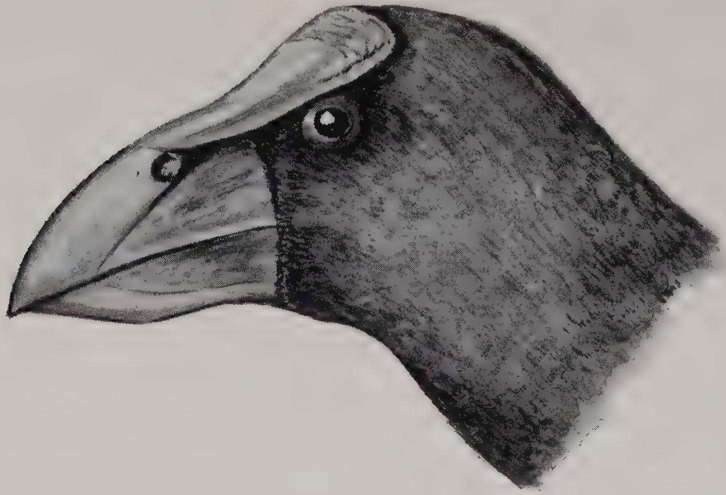
The short, deep, bill and the frontal shield extending over the eyes, together with the long legs and toes serve to distinguish this genus. The general colour is blue. The long primaries and legs and less deep bill with more extensive shield distinguish it from Notornis.

There are about five or six species ranging over the temperate and tropical portions of the Eastern Hemisphere.

Reference.—Brisson, Orn. 5, 522, 1760 (*Porphyrio*, type *Fulica porphyrio* L.).

Swamp Hen. Pukeko
Porphyrio melanotus stanleyi

In the Liverpool Museum is a single specimen of a white Swamp Hen bearing the label "White Gallinule," while an entry in an auctioneer's catalogue referring to this bird states: "New Zealand, rare; brought by Sir J. Banks." The bird has been much discussed and the concensus of opinion now is that the data can be accepted as evidence that the first discovery of the Pukeko, as it is commonly called in New Zealand, was made by Sir Joseph Banks, in 1769 or 1770,



C. McCann

PUKEKO

during Cook's first voyage, and that he collected an albino. The species was next referred to by Crozet who, while at the Bay of Islands in 1772, recorded the presence of "Blue Fowl," while Yate, in 1835, stated that it lived in swamps, robbed potato fields and was rejected as food by the Maoris. The earliest specimens to reach the British Museum were collected shortly after this at the Bay of Islands and at Mataineka in the South Island, the latter by P. Earl about 1840.

Adult. Head sooty black; back and upper surface of wings and tail black glossed with green; marginal and primary coverts and quills black edged with purplish; throat, neck all round, breast, sides of body and under wing coverts purplish blue; abdomen, axillaries and thighs sooty black, under tail coverts white, bill and iris red. Feet red, claws and soles brown. Bill and frontal plate 67-73, wing 280-300, tail 110-118, tarsus 90-104, mid toe 100-115 mm. *Immature.* Upper surface blackish brown tinged on the wings with blue; chin pale brown; foreneck and breast blue, the feathers edged with fulvous brown; abdomen pale fulvous brown; under tail coverts yellowish white. Bill brownish black, reddish at base and on frontal plate. Iris brown. Feet dark brown with reddish tinge. *Nestling.* Above and throat jet black, lower surface sooty black. Head, back and wings with silvery grey tips (sheaths) to the down feathers. Bill greyish white, black at tip. Feet purplish grey.

Colour varieties. The Pukeko seems particularly prone to albinism. The most famous of the albinos of this species is the "White Gallinule" already mentioned as being brought to England by Sir Joseph Banks. This bird, which I have examined and which has been many times described, figured and discussed, and even referred to the genus *Notornis,* is white with, in certain lights, a bluish gloss. There are a few brown or blue feathers on the head, back, wings, tail and breast. Other specimens since obtained are (1) pure white (Lake Grassmere); (2) wings white, otherwise normal; (3) mainly brownish white blotched with dark brown above and blue below, head and neck normal except for freckling of pale brown and white on nape (Manawatu); (4) pale brown, yellowish white, or white feathers mixed with the normal plumage (numerous examples). Several Pukekos with isabelline buff replacing black and pale violet replacing purplish blue, with white under tail coverts, and their buff nestlings are recorded by J. M. Cunningham from Matahiwi (Wairarapa).

Eggs. Clutch five to seven, ovoid, stone to reddish stone colour with dark brown to reddish and grey blotches all over, sometimes more at the larger end, 50 x 36.5, 47.5 x 34.5, 51 x 35.5 mm. Heathcote Estuary.

Status. The purple gallinules have recently been included in a single species, *P. porphyrio*. This hardly gives a true picture of what occurs in nature which is that members of the genus can be arranged in groups (species) including subordinate groups (subspecies). I suggest that it would be reasonable to admit at least four species, associating in each closely allied forms as subspecies. No one so far as I am aware has published a revision of the genus since Sharpe's account in the Catalogue of Birds in the British Museum, vol. 23, 1894. If Sharpe's treatment is to be relied on there appear to be definable groups associated with the greenish blue *porphyrio,* the grey-headed *poliocephalus* and the purple and brown *melanotus,* with others such as the bluish grey *pulverulentus* and the white *albus*. Until the genus is revised I see no reason to disturb the use of *melanotus* as adopted by Mathews and Iredale. It would include several subspecies in Australia and the western Pacific.

Distribution. Kermadec Islands: occasional visitor. North and South Islands. Three Kings, accidental. Great Barrier Island. Little Barrier Island, rare visitor. Mayor Island. Kapiti (occasionally). Stewart Island. Chatham Islands. Straggler to Campbell Island. Abundant in most places, increasing in many localities, decreasing in others.

Ecology. The Pukeko is a characteristic bird of the raupo swamp. It is also common enough in all swampy situations and has

Auckland *G. A. Buddle*

PUKEKO

taken kindly to cultivated districts. It is one of the species of New Zealand birds that has responded favourably to the changes in conditions that have come in with European settlement. The clearance of forest and fernland and their replacement by grass has provided it with large new areas of suitable feeding ground, while the draining of swamps has reduced the water area and in its place there may be much damp or dry grassy ground. This large expansion of open country covered with herbaceous plants has brought with it much insect and plant food. "The Pukeko," says Guthrie-Smith, "proved able to thrive better on dry ground than on wet, on grass and clover than raupo and sedge." It is a bold, fearless bird, its bright colours make it an ornament in the fields, and its confiding ways have endeared it to all who take an interest in Nature. It has learned that trains and motor cars are harmless and takes no notice of them, nor is it much disturbed by the presence of people who do not molest it. It is likely therefore to maintain itself in all sparsely populated districts. The Pukeko runs swiftly, is a good flyer though not often rising from the ground, and it swims well.

Pukekos are often attacked by harriers, while rats and stoats plunder their nests. Harriers are dealt with by the Pukekos gathering together and driving them away. According to Mr. J. Morris, of Charleston, the Pukeko hunts and kills stoats. All the Pukekos in the neighbourhood, he says, join in the fight.

The Pukeko is said to be conscious of its bright red bill disclosing its presence to its enemies and attempts to hide it while sitting on its nest by holding its head downward over the edge.

The Pukeko is a useful bird insofar as it destroys caterpillars and crickets in cultivated ground. Its crime list, however, is rather a formidable one. It is an old hand at plundering, as Yate, in 1835, reported that it robbed potato fields. Its marauding excursions are usually carried out at night. To get grain it pulls the straws carefully out of the stacks, also young shoots as they appear above the ground. It eats potatoes, kumaras and other vegetables and, when large numbers are present, a considerable amount of clover and grass. Given a chance it will eat the eggs of fowls and ducks and will kill young ducks of which it may eat only the head.

Food. The Pukeko's food is largely vegetable—soft shoots and roots of water plants which it holds up to its beak with one foot. Berries and seeds are also eaten and various kinds of animal food—worms, insects, freshwater mussels, fishes, frogs, lizards, young birds and birds' eggs. Flounders up to five inches and eels up to seven inches in length are recorded as having been caught by Pukekos.

Nesting. The site of the Pukeko's nest is perhaps most often in a raupo swamp where a large untidy structure of raupo leaves a foot or so high is built. On the borders of large sheets of water which are liable to rise with an inshore wind the nest is so made that it rises with the water. Other sites for Pukekos' nests are under large tussocks of flax, sedge or grass and on top of nigger heads (*Carex secta*). The nest is usually near water, though occasionally it may be some distance away. The building materials vary with the type of vegetation, but are always long coarse leaves such as raupo (*Typha*), sedge or grass. The usual months for laying are September to December, but eggs may be found as late as March or even June. The male bird apparently does most, perhaps sometimes all the incubation, but when the young are hatched the hen takes charge of them. Partnership nests, that is, those in which several females associate with a single male are described by Guthrie-Smith: "I have seen a Pukeko's nest containing seventeen eggs—a co-partnership of four or five or even six hens—and on several occasions have also seen in nests of this species ten or twelve eggs, the property of three of four hens." Again: "Sometimes a new nest, or rather platform, on a flattened niggerhead summit, is specially built for the nestlings, though this may, and probably does only happen in a partnership nest, when, as the eggs hatch, each hen takes away her share of the chicks." The young leave the nest shortly after hatching.

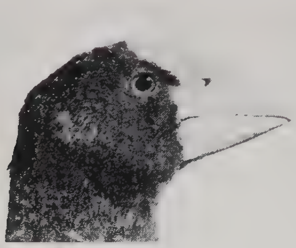
References.—Temminck, Man. Orn. (2) 2, 701, 1820 (*P. melanotus*, New South Wales). Rowley, Orn. Misc. 1, 37, 1875 (*P. stanleyi*, albino, New Zealand). Buller, Birds N.Z. 185, 1872; 2nd ed. 2, 79, col. pl. 1888. M'Lean, Emu, 1, 52, 1902. Guthrie-Smith, Birds Water, Wood, Waste, 67, 1910. Sharpe, Ibis 1893, p. 531 (*P. chathamensis*).

Genus Notornis

Bill short, deep, compressed, nostrils circular, no nasal depression. Frontal shield extending to just over the eyes. Wings short, quills short, third to seventh longest, secondaries nearly as long as primaries, wing coverts long. Tarsus shorter than middle toe and claw; hind toe short, elevated.

Allied to Porphyrio, but differing in the deep, stout bill, short wings and short, stout legs. Notornis is a flightless relation of Porphyrio from which it differs in those characters which might be expected of a bird assuming a sedentary ground habit, for while its wings have degenerated, it has developed in size and in strength of bill and feet. In general type of coloration it resembles Porphyrio. The structural changes are paralleled in the other flightless birds of New Zealand.

Notornis is restricted to New Zealand and includes two species; an extinct form (*N. mantelli*) from the North Island and a recent species in the South Island. Only skeletal features can be compared, the principal morphological difference being shown in the skulls. In South Island skulls the temporal fossae extend over the cranium further than they do in North Island skulls. Few specimens are available for comparison but those I have measured give a breadth between the temporal fossae of 13.5 to 17 mm. for South Island skulls (*N. hochstetteri*) and 16 to 24 mm. for North Island skulls (*N. mantelli*).



J. T. Salmon

TAKAHE

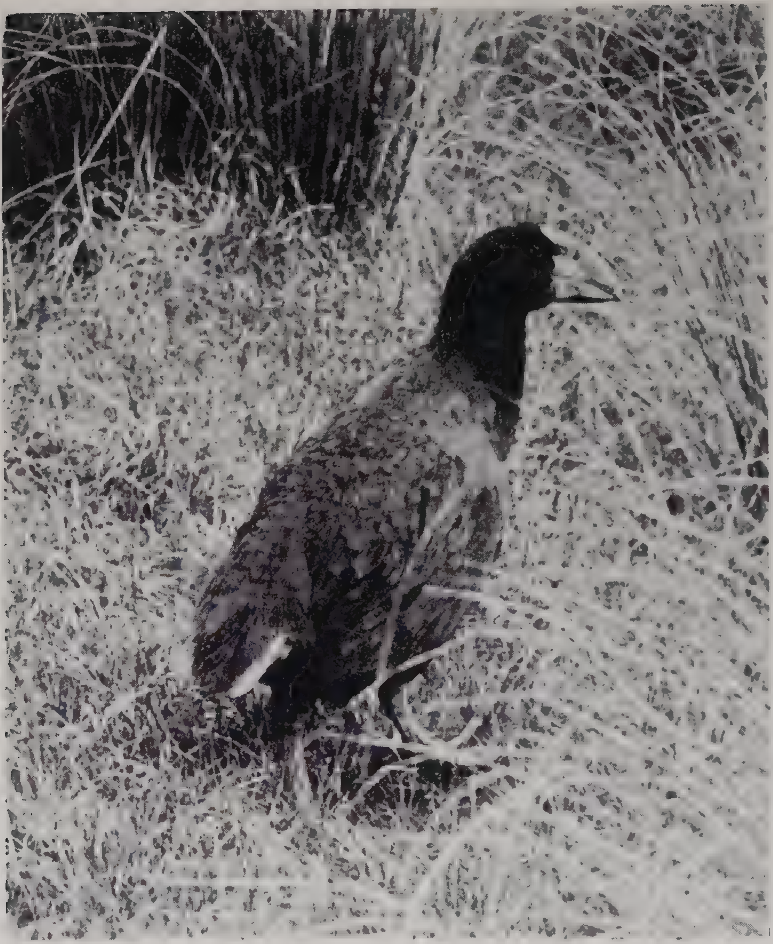
References.—Owen. Proc. Zool. Soc. 1848, p. 2 (*Notornis*, type *N. mantelli*). Mathews, Birds Austr. 1, 249, 1911 (*Mantellornis*, type *Notornis hochstetteri* Meyer).

Takahe

Notornis hochstetteri

Up to 1898 four specimens of the Takahe were captured. The discovery of the first specimen, in 1849, at Duck Cove, Resolution Island, is thus described by Dr. Gideon Mantell when exhibiting the skin at a meeting of the Zoological Society in London. "This bird was taken by some sealers who were pursuing their avocations in Dusky Bay. Perceiving the trail of a large and unknown bird on the snow with which the ground was then covered, they followed the footprints until they obtained a sight of the Notornis, which their dogs instantly pursued, and after a long chase caught alive in a gully of a sound behind Resolution Island It ran with great speed, and upon being captured uttered loud screams, and fought and struggled violently; it was kept alive three or four days on board the schooner and then killed and the body roasted and eaten by the crew, each partaking of the dainty which was declared to be delicious. The beak and legs were of a bright red colour. My son secured the skin." The son referred to was Mr. W. B. D. Mantell, of Wellington. The skin is preserved in the British Museum.

The second specimen of the Takahe was caught, in 1851, by a Maori on Secretary Island, opposite to Deas Cove in Thompson Sound. This specimen was also secured by Mr. W. B. D. Mantell and is now in the Dominion Museum, Wellington.



Murchison Range *H. J. Ollerenshaw*

TAKAHE

One of these birds is the subject of a coloured illustration by J. G. Keulemans in the first edition of Buller's *Birds of New Zealand*. This is the best picture so far published though the colour of the bill is not correct.

Nearly thirty years elapsed before the Takahe was again seen. The third example was taken in December, 1879, north of the Mararoa River, three and a half miles east of its tributary the Whitestone, and nine miles south east of the south end of Lake Te Anau. A rabbiter's dogs one day ran down a large bird which was caught alive. Taking the bird from the dogs the rabbiter killed it and hung it up on the ridge pole of his tent. The following day the station manager, Mr. J. Connor, visited the camp and was given the bird. Suspecting that it was a Notornis, Connor took it to the station where he carefully skinned it, preserving both the skin and the bones. This specimen was sent to London for sale but found no buyer for two years. It was then purchased by Mr. Oscar Loebel for £110 and presented to the Dresden Museum. The specimen disappeared during the second world war. It was the type of *Notornis hochstetteri* and is figured by Keulemans in the second edition of Buller's *Birds of New Zealand*. The colouring of the plate is, however, very bad.

Again a long period, nearly twenty years, elapsed without the Takahe being seen. On the evening of August 7th, 1898, Donald Ross was walking along the shore of the Middle Fiord, Lake Te Anau, when his dog suddenly darted into the bush and shortly after emerged with a bird in its mouth. The bird was not quite dead, but expired a short time after it was brought to the camp. Recognising the bird to be a Notornis, Ross and his brother rowed with it to the south end of the lake, a distance of twenty-five miles, and despatched it to Invercargill. The whole specimen—skin, bones and internal organs were preserved and described. The skin, now mounted in the Dunedin Museum, was purchased by the New Zealand Government for £250.

Fifty years three and a half months after this fourth bird had been captured the people of New Zealand and indeed of the whole world were told that a colony of Takahe had been found in a glacial valley at the eastern end of the Murchison Range 2,200 feet above Lake Te Anau. The news was received as a notable ornithological event. The discovery was not just a lucky accident of a deer stalker but was the result of a planned search for the mysterious bird, entirely due to Dr. G. B. Orbell, of Invercargill. Orbell first visited the valley in April, 1948, and found footprints of an unknown bird but from his description they could not definitely be identified. Allowing the winter to pass Orbell set out again and on November 20th the birds were actually seen and two caught in a net taken up the mountain for the purpose. After being photographed the birds were released. The subsequent history is that four expeditions under Government direction visited the locality in 1949 to gain information as to the number of birds present, their feeding and nesting habits and especialy their chance of survival. Since this first year of intensive investigation two or more trips annually have been made by Government officers, generally with a scientist attached, and a good deal of information about the birds has now been obtained. For the purpose of making a survey of the vegetation of the valley I was granted the privilege of joining a Government party in February, 1952. A bird was seen on three occasions.

Adult. Head, neck, breast and flanks irridescent indigo blue, becoming peacock blue on the shoulders; mantle sage green; back, scapulars, lesser wing coverts, rump, upper tail coverts and tail olive green; greater wing coverts blue margined with verditer green; quills indigo blue, dusky brown on the inner webs near the shaft; thighs and abdomen bluish black; under tail coverts white. Bill: basal part and shield scarlet, remainder rose pink. Iris reddish brown. Feet red, claws horn brown. Bill and frontal plate 83-86, wing 248-255, tail 114-121, tarsus 83-89, mid toe 89-95 mm. *Immature.* Head greyish blue, whitish round base of bill; back and wing coverts brown, the feathers tipped with green; quills blue with brown and green markings. Under parts buffish grey. Bill brownish black, base black. Feet light reddish brown (E. G. Turbott, Feb. 21). *Nestling* covered with black down, with white patch on front edge of wing. Bill black with white tip. Legs disproportionately large, pale purplish. A well developed spur at the humeral flexure. "At about a month the plumage is still much the same but the bill has become a dark steely grey except for the tip, and the legs have already begun to change to the adult coloration by showing a narrow anterior, vertical rust-coloured stripe." (Williams.)

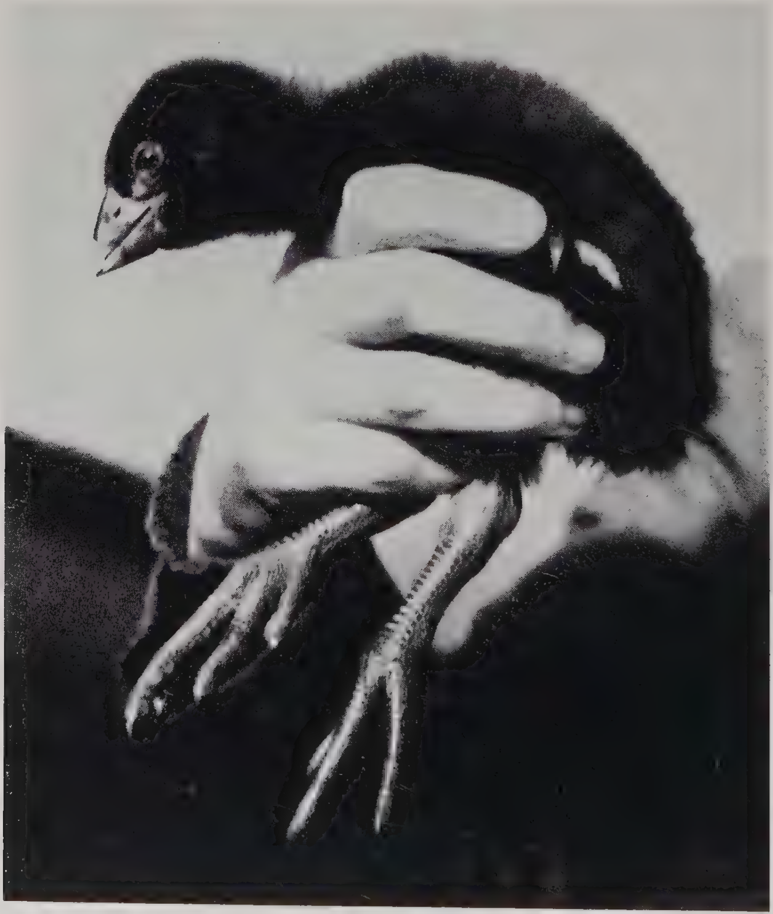
Eggs. Clutch two, elliptical, rounded nearly the same at both ends, dull cream with brown and mauve blotches, not closely spaced, all over. 73.5 x 48.3, 74.5 x 48.5, 74.5 x 49 mm. The last two from the same nest.

Distribution. Formerly widely distributed over the South Island. Now confined to Fiordland where it is known to occur only in the Murchison and Kepler Ranges. Resolution Island, 1849. Secretary Island, 1851. Mararoa River, east of Lake Te Anau, 1879. Middle Fiord, Lake Te Anau,

1898. Takahe Valley, 1948. Subsequently found in several other montane valleys on the east and south sides of the Murchison Range and on the Kepler Range.

Skeletons and bones have been found at Patience Bay, Lake Te Anau, at Waitati and at Dusky Sound. Subfossil bones have been found with moa bones at Castle Rock, Earnscleugh Cave, Greenhills, Enfield, Kapua, Pyramid Valley, Aniseed Valley and other places in the South Island.

Ecology. The known stations where the Takahe at present exists are tussock grassland from 2,000 to 3,500 feet above sea level and adjacent forests which in Takahe Valley are of mountain beech with a little silver beech. The Takahe feeds principally in the grassland and it breeds in the same plant formation in Takahe Valley at an elevation of 2,900 feet and in Point Burn Valley at 2,000 feet. At Takahe Valley the birds cross a belt of forest between the flat nesting ground on the floor of the valley and the tussock covered hill tops 500 feet above. One Government party reported hearing a Takahe in the forest about half-way between Lake Te Anau and the floor of Takahe Valley, that is, at an altitude of about 2,000 feet. In winter in Takahe Valley snow falls to a depth of a foot or more and the lake



Murchison Range *J. H. Sorensen*

TAKAHE CHICK

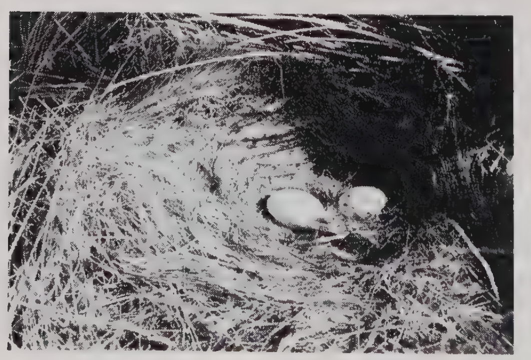
freezes. Snow may fall at any time of the year. The rainfall is probably about 100 inches a year. In his visit to Takahe Valley on August 22nd, 1949, Turbott found the Takahe on the snow covered flat. Whether some of the birds descend the mountain in winter is not known.

The total number of Takahe thought to exist is probably over a hundred adult birds distributed, as far as is known, over the Murchison Range east of the main divide and on the Kepler Range. According to Cowan, who relies on the evidence of some Maoris, the Takahe was once common round the shores of Lakes Te Anau and Manapouri in winter time when the snow drove it down from the mountains. A hundred years ago two birds were killed at sea level on the west coast. The third and fourth birds were taken at an altitude of about 700 feet near Lake Te Anau. The evidence, therefore, admittedly quite inadequate, could indicate a contraction of the range of the Takahe and a retreat to higher altitudes. These are signs that the species is near the point of extinction. It is indeed unlikely that the species was discovered on the Murchison range exactly at the point when recovery had commenced. But while hoping that this is so we must realise that there is no evidence to indicate that there has been any increase in the Takahe population during the past three years, and secondly, that introduced mammals, especially stoats and deer, are invading the breeding area of the birds. If each of the pairs of birds, assuming the sexes being exactly equal in number, laid two eggs in a season and all the eggs produced chicks which grew to maturity, there would be a doubling of the population each year. Instead, however, we know that there is little or no increase. We do not as yet know the causes. Deer and stoats have no doubt caused some casualties, stoats are known to have destroyed eggs and killed chicks, but probably the weather is the cause of most of the destruction of eggs and young. Rain falls abundantly during all months of the year, snow falls heavily during the winter months and may fall during any month of the remainder of the year. Thus snow storms might easily wipe out the greater number of chicks hatched. Lastly, as with species nearing extinction, vitality may be waning, giving a high rate of infertility among the eggs. It will take a good deal of study in the breeding area to determine the relative importance of these factors. My impression is that the inhospitable climate is the most potent factor leading to the decline of the species, but not the only cause, as some pairs which have been watched for a few years have not brought up any chicks.

Food. All the evidence so far gathered shows that the Takahe, after the first few weeks of its nestling life, feeds entirely on seeds and the soft parts of plants. Its main food is the soft bases of the leaves of the snowgrass (*Danthonia flavescens*). The rest of the leaf, that is the blade and most of the sheath, is to be seen scattered untidily about the ground in the tussock grassland where the birds feed. The dried droppings of the birds, which persist for a long time, consist mainly of indigestible parts of grass leaves and undigested spikelets of *Danthonia* and *Poa*. Falla records seeing a bird stripping *Danthonia* of flowers and seeds by running the stalks from base to tip through its beak. He also states that "*Carex* is pressed over with one foot, loosened at ground level with grubbing strokes of the beak, and then held in the closed foot while the succulent bases are bitten off." More remarkable is the fact, shown in a photograph by Sorensen, that the Takahe eats the flowering stalks of *Aciphylla* plants from which it first strips the spiny bracts. *Aciphylla* has dagger-like leaves effectively protecting its base but the Takahe can reach the flower stalk, not so well armed, by reaching over the tops of the leaves. I saw no plants of this species above the lake and only a few below it so it can form only an inconsiderable part of the Takahe's food. Leaf bases of Celmisia are also eaten. Besides these white portions of plants there is evidence that the Takahe eats green herbaceous plants. From observations made by Gurr it was ascertained that the nestling, for the first few weeks of its life, is fed on insects, spiders, opiliones and worms, which are obtained by the parent birds searching in sphagnum and other kinds of moss. Travelling over the tussock flat one here and there comes across patches of moss pulled about by the Takahe.

Voice. The presence of the Takahe is usually first indicated by hearing its alarm call which to me sounded like "oomf" repeated slowly and in a rather low tone. This call has been noted by all observers. Then there is a call which sounds something like the call of a weka. Fleming renders this and the reply as "coo-eet" repeated. The cry of the chick is, according to Fleming, a slow "wee-a" or a repeated "weedle," while the parent, supposed to be the female, keeps in contact with the chick by the "cowp" call.

Nesting. All the nests so far found have been in the tussock grassland on the flat ground of Takahe and Point Burn Valleys. They are placed in a kind of bower between tussocks of *Danthonia* and thus have an entrance back and front. There is a thick lining of grass leaves. Two is the normal number of eggs in a clutch. The earliest date on which eggs have been found is October 25th when, it was estimated, the nest with its two eggs had been occupied less than a week. Another nest found on December 1st contained two eggs, and a third nest had one egg on December 6th. A half-grown chick was found on December 13th, and on January 10th Sorensen found a nest with a chick, a week or so old, in it. A half-grown chick from the nest with two eggs found on December 1st was seen on February 7th. Thus the time when eggs are in the nests extends from mid-October until the end of December, and young in down may be seen during the two following months.



Murchison Range *E. P. Christensen*
NEST OF TAKAHE

In summing up observations made during two seasons Williams says that after building a number of nests the last made is apparently the one used and one or two eggs are laid in it. Incubation is carried out by the smaller bird, presumably the female, which begins to sit on the eggs within three or four days of the completion of the nest. Most, if not all of the birds breed yearly but very few chicks are reared.

The following additional information has been kindly supplied me by Mr. Williams: "We now know—as a result of the banding operations—that Takahe will breed twice in one season. On about 15th February, 1954, Miers, Bull and myself saw a chick only a few days old in the company of a parent bird that we know was raising another chick (the fate of which is unknown) in the same area in December. We also know of one case of a Takahe that had been banded as a chick breeding in the next season, that is, at the beginning of its second year."

References.—Meyer, Abbild. Vog. Skel. p. 28. 1883 (*Notornis hochstetteri,* Mararoa River). Buller, Birds N.Z., 189, col. pl. 1872; 2nd ed., 2, 85, col. pl. 1888; Suppl. 1, 66, 1905. Parker, Trans. N.Z. Inst. 14, 245, 1882 (skeleton); 18, 78, 1885 (skeleton). Benham, Trans. N.Z. Inst., 31, 146, 1899; 31, 157, 1899 (viscera). Rothschild, Extinct Birds, 142, col. pl. 1907. Orbell, Illustrated London News, 26th February, 1949. Falla, Emu, 48, 316, 1949. Williams, Discovery, July 1950, p. 216; Notornis, 4, 202, 1952. Falla, Fleming, Turbott, Gurr (4 papers), Notornis, vol. 4, 1951. Internal Affairs Dept., Notornis, 5, 144, 1953.

GENUS TRIBONYX

Bill short, compressed, depth at base more than half length; nostrils in anterior end of nasal depression. An indistinct frontal plate at base of culmen, not covering the forehead. Legs long, tibia exposed for half length of tarsus or less.

Two species found in Australia and Tasmania.

References.—Du Bus, Bull. Ac. R. S. Brux., 7, 212, 1840 (*Tribonyx,* type *T. mortieri* Du Bus). Sharpe, Bull. Br. Orn. Club, 1, 29, 1893 (*Microtribonyx,* type *Gallinula ventralis* Gould).

Black-tailed Water Hen

Tribonyx ventralis

Only one specimen of the Black-tailed Water Hen has been taken in New Zealand. The bird was shot by Mr. Cook at Oraki, near Colac Bay, Southland, in June, 1923, and was forwarded to the Otago Museum.

Adult. Upper surface olive brown with a greenish tinge; head and wings browner than the back; first primary edged with white; quills and tail blackish. Lores, side of face and throat black; lower throat, foreneck and breast dark slate-grey; abdomen, thighs and under tail coverts black; sides of body, under wing coverts and axillaries brown; long flank plumes black with white pear shaped spots at tips. Bill pea green; base of lower mandible reddish orange, both mandibles tipped with pale green. Iris orange. Feet red. Bill including frontal shield 32, wing 220, tail 85, tarsus 60 mm. The female is smaller and the flank plumes are grey. *Nestling.* Covered with greenish black down; bill as in adult.

Eggs. Clutch five-seven, pale green, minutely spotted all over with brown, and with fewer large blotches of chestnut-brown and grey, 45.5 x 30.5 mm. (av.).

Distribution. Oraki (Colac Bay). Other specimens without data in museums. Australia.

Habits. In Australia the Black-tailed Water Hen is to be found along water courses and in swampy places and in the drier districts moves from place to place in large flocks in accordance to the state of the water holes. Its food consists mainly of insects. The nests are made of grass and generally placed on the ground in swampy localities, but sometimes in a low bush near water.

References.—Gould, Proc. Zool. Soc. 1836, p. 85, 1887 (*Gallinula ventralis,* Swan River). Mathews, Birds Austr. 1, 227, col. pl. 1911.

FAMILY FULICIDAE. COOTS

Bill stout, compressed. A large frontal shield. Toes lobed laterally.

GENUS FULICA

Bill stout, compressed, deep at base, nostrils at anterior end of nasal grooves. Frontal shield large, extending over eye. Primaries and secondaries equal in length. Tarsus shorter than middle toe and claw, compressed, with a posterior fringe. Toes with wide scalloped lobes.

About ten species distributed over the whole world, but mostly American.

Reference.—Linne, Syst. Nat. 10th ed., 152, 1758 (*Fulica,* type *F. atra* L.).

Coot

Fulica atra australis

Seven instances are on record of this widely ranging species having been taken in New Zealand. The first specimen to be taken was shot at Lovells Flat, about 1875. The second was shot at Lake Waihola in July, 1889; the third at Kaitangata by A. Mathews in May, 1919; and the fourth at Mataura Island by G. Dickson in July, 1920.

Adult. Head and neck black; upper surface lead grey; primary coverts and quills dark brown; white at bend of wing; tail black. Under surface light slate grey; under tail coverts black. Bill bluish grey. Iris red. Feet steel grey. Bill including frontal shield 42, wing 190, tail 45, tarsus 55, mid toe 76 mm. *Nestling.* Covered with black down with yellow hair-like tips, thickest about face and neck.

Eggs. Clutch six or seven, oval, stone colour, minutely dotted with black all over, 48.5 x 35.5, 45.7 x 33 mm. Tasmania.

Status. Though a widely distributed species, subspecies have not been satisfactorily defined. Australian specimens agree with European ones except that they are smaller and the secondaries lack whitish tips.

Distribution. Seven occurrences. Lovells Flat. Lake Waihola (2), Kaitangata, Mataura, Mataura Island. South Westland. Riverton.

Australia. Tasmania.

Habits. The specimens of coot found in New Zealand are probably stragglers from Tasmania. In that country, according to Miss Fletcher, the coot frequents reed swamps bordering lagoons or lakes. The nests, which are neater and more basket shaped than the swamp hen's, are made of coarse rushes, bitten into lengths and are without lining. They are built in reeds standing in one or two feet of water and about six inches above the surface. Generally the clumps of rushes in which the nests are built are near open sheets of water.

Describing the nests of the same form in Victoria, S. A. White states that they are built of sticks lined with grass and other leaves and were floating on water, but always attached to a submerged branch.

The food consists of insects, molluscs and green plants. The latter includes grass and water plants obtained by diving.

References.—Linne, Syst. Nat. 10th ed. 152. 1758 (*Fulica atra,* Sweden). Gould, Proc. Zool. Soc., 1845, p. 2 (*Fulica australis,* Western Australia). Buller, Suppl. Birds N.Z. 1, 75, 1905.

ORDER ARDEIFORMES

HERONS, IBISES, SPOONBILLS

Bill long. Part of head naked. Legs long, the lower part of the tibia bare; hind toe long. Young born in a helpless condition, and passing through a downy stage.

Key to Families

Bill straight	*Ardeidae*
Bill curved	*Plegadidae*
Bill flattened	*Plataleidae*

FAMILY ARDEIDAE

HERONS, EGRETS, BITTERNS

Bill straight, pointed, notched. Loral space bare. Outer toe with a broad basal web, middle claw, pectinated.

Many of the species are furnished with ornamental plumes during the breeding season, on the head, back or breast.

Key to New Zealand Genera

Tail feathers 12.	
Two long nape plumes; lengthened feathers on back and lower foreneck; plumage grey above, white below	*Ardea*
Long dorsal train; plumage white	*Egretta*
Lengthened feathers on head, back and breast	
General colour dark slate, chin and throat white	*Demigretta*
General colour ashy, face white	*Notophoyx*
Three long nape plumes; plumage chestnut above, white below	*Nycticorax*
Tail feathers 10.	
Tarsus equal to bill; wing about 150 mm.	*Ixobrychus*
Tarsus longer than bill; wing about 370 mm.	*Botaurus*

GENUS ARDEA

Bill stout, shorter than tarsus, edge of mandibles distinctly serrated; a faint notch near the tip of the upper mandible. Two long nape plumes, lengthened feathers on back and breast. Bare portion of tibio-tarsus exceeding length of inner toe and claw. Tail feathers 12.

Large birds distinguished by their stout pointed bills and long legs and by the characters of the head crest.

About ten species distributed over all the continental regions; accidental in New Zealand.

Reference.—Linne, Syst. Nat., ed. 10, 141, 1758 (*Ardea*, type *A. cinerea* L.).

Grey Heron

Ardea cinerea rectirostris

The Grey Heron has been obtained only once in New Zealand, an example having been caught on board a schooner off the east coast about 1898.

Adult. Above light grey; a crest on the head, white in centre, purplish black on each side, ending in a crest on the occiput and with two long nuchal plumes; scapulars and inner secondaries forming narrow drooping plumes of grey or white; primary coverts and quills purplish black. Sides of face, neck all round and under surface white; black stripes on foreneck and breast, the feathers being lengthened into drooping plumes; sides of body purplish black. Bill yellow, culmen brown at tip. Iris yellow. Skin between bill and eye green. Tibia yellow, feet dull green. Bill 125, wing 450, tail 165, tarsus 165 mm.

Eggs. Clutch three-four, light greenish blue, 59.6 x 42.8, 58.8 x 43 mm.

Status. Three subspecies of the Grey Heron are recognised, the New Zealand straggler doubtless belonging to the East Asiatic subspecies *A. c. rectirostris.*

Distribution. Off east coast North Island, one specimen.

Siberia, breeding. Other subspecies in Europe, Asia and Africa.

Reference.—Linne, Syst. Nat., 10th ed., 143, 1758 (*Ardea cinerea*, Europe). Buller, Trans. N.Z. Inst., 31, 28, 1899. Gould, Proc. Zool. Soc., 1843, p. 22 (*Ardea rectirostris*).

GENUS EGRETTA

Bill long, stout, shorter than tarsus, an indistinct notch at the end of the upper mandible. A well developed dorsal train of filamentous plumes; breast and head plumes present in some species. Tail feathers 12.

Includes the Great White Egret and two other species which differ from it in the bill being serrated and in having crest and breast plumes in the breeding season.

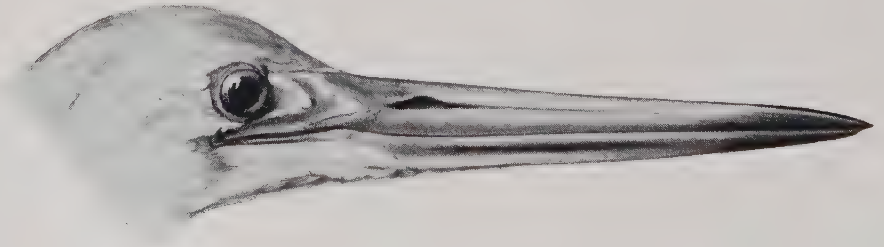
Large white birds distinguished by the filamentous dorsal plumes.

References.—Forster, Syn. Cat. Br. Birds, 59, 1817 (*Egretta*, type *Ardea garzetta* L.). Gloger, Hand-u. Hilfsb., 412, 1842 (*Casmerodius*, type *A. egretta* Gmel).

Eastern Great White Egret. Kotuku
Egretta alba modesta

The White Egret was first observed in New Zealand by Captain Cook during his second voyage. Subsequently it was noted in various parts of the country, but always it was considered a rare bird. Thus about 1840 Percy Earl, who had a skin, was offered a large pig for it by a Maori chief. It was not until December 1865 that a surveyor named Mueller discovered its only known breeding place in New Zealand on the banks of the Waitangituna Stream, near Okarito.

Adult. Entire plumage white. The dorsal train extends beyond the end of the tail usually about 100 mm. but Buller records one nearly 180 mm. (seven inches). Bill in breeding season black, the tip slightly yellowish. Iris bright yellow. Skin between eye and bill yellowish green. Feet black, the tibia tinged with yellow. In the non-breeding period the bill is yellow with the tip brownish and there are no dorsal plumes. Bill 100-130, wing 350-420, tail 160-180, tarsus 140-170, mid toe 100-130 mm. *Immature.* The White Egret was studied in its breeding place by J. Morton who concluded that it takes three years to reach maturity. First-year birds have yellow bills, skin on sides of head greenish yellow and no dorsal plumes. Second-year birds have the bill yellow with tip dark, and small dorsal plumes develop in May. *Nestling.* Covered with yellowish white down, long and upright on the crown. Bill dull yellow with black tip. Feet black. *Colour varieties.* Scattered black feathers are sometimes present on the wings, especially the under surface. A specimen described by T. W. Kirk had a patch of black and brown on each wing joined by a band across the back. There was also a band across the breast, the under surface of the wings were marked with



Lily A. Daff

EASTERN GREAT WHITE EGRET

brown and black and there was a black patch on one of the plume feathers.

Eggs. Clutch three or four, ovoid, pale blue, 54 x 39.5, 59 x 39.5 mm. Waitangituna River.

Status. Three subspecies are recognised. *E. a. alba.* Bill black in breeding season, tibia flesh-coloured. Europe, Africa, Central Asia. *E. a. modesta.* Closely allied to *E. a. alba.* East Asia to Australia and New Zealand. *E. a. egretta.* Bill yellow at all times; tibia black. United States to Patagonia.

Distribution. Breeds in the Okarito district, Westland. Stray pairs or individuals have been recorded from all parts of the North, South, Chatham and Stewart Islands. The following localities selected from a large number of records show how widely the White Egret wanders over New Zealand: Parengarenga Harbour, Great Barrier Island, Bay of Islands, Kaipara Harbour, Whangape Lake, Raglan, Rotorua, Tauranga, Lake Taupo, Waikaremoana, Napier, Foxton, Lake Wairarapa, Wellington Harbour, Picton, Takaka, Collingwood, Westport, Lake Brunner, Lake Ellesmere, Waikouaiti, Lake Wakatipu, Kaitangata, Paterson Inlet. Stragglers have been observed at the Chatham, Auckland and Macquarie Islands. Potts, writing in 1873, said that, in the north of the South Island, "a vast white heronry has been destroyed or forsaken by the kotuku in consequence of ceaseless persecution."

India, central China and Japan southward to the Malay Archipelago, New Guinea, Australia and New Zealand. Stragglers reported at Lord Howe and Norfolk Islands.

Ecology. The shallow waters along the margins of rivers, inland lakes, swamps and coastal estuaries and lagoons, including sometimes the sea beach, are the stations frequented by the White Egret.

Its long legs, bare of feathers well above the ankle joint, and long spreading toes fit it especially for wading on a muddy bottom. When disturbed it rises high into the air in wide circles with slow regular flapping of the wings and with the head close to the body, then the legs are drawn up close to the tail and it takes a more direct course. From the only known breeding place in New Zealand on the Waitangituna River the White Egret, after the breeding season, disperses singly or in pairs to all parts of New Zealand. Both immature and adult birds take part in this dispersal. Occasionally birds in full breeding dress stray far from their home, one with ample plumes having been taken at the Bay of Islands. In the breeding colony the egrets are closely associated with the White-throated and Little Pied Shags, there being many more shags than egrets. It has been suggested that the egrets benefit from their association with the shags by eating fish disgorged by the shags, such food being especially useful at the time when the young egrets are being reared, while the shags have the advantage of the protection of their sharp-billed companions. The idea that shags need protection is, however, far fetched as the only enemy of shags in New Zealand is man.

Food. The food of the White Egret consists mainly of small fishes, including eels. Standing in water as deep as its long legs will allow without wetting its feathers, it remains perfectly still until a fish comes within reach, then with lightning-like rapidity it strikes with its bill and at once swallows the prey it has caught. In addition to fish, the food of the White Egret includes shrimps, insects and birds. The White Egret has been seen to take silver-eyes, sparrows, ducklings, chickens and a kingfisher. An eye-witness, Mr. L. K. Clark, thus describes the egret's method of taking birds. "In August, 1947, towards the mouth of the Big Wanganui River, South Westland, I saw a white heron catching and devouring silver-eyes (*Zosterops lateralis*). The silver-eyes were feeding on insects in the low bushes along the riverbank—the heron stood like a statue in the shade of one of the bushes until the birds gradually approached to within two or three feet of the heron.

Immediately the heron began to sway its neck backwards and forwards, at the same time moving forward. Suddenly there was a flash and the heron would have the silver-eye. He next proceeded to swallow it head first, feathers and all, in several large gulps. The whole action occurred in a very short time. The silver-eye seemed mesmerised for an instant by the swaying movement of the heron's neck. Three times this took place that afternoon. Often the heron would be unsuccessful and would get in what appeared to be a great rage over missing his prey." Mrs. B. Whittaker, of Howick, watched a White Egret systematically robbing a Pied Shag of its fishes as the shag surfaced.

Nesting. The only known nesting colony

Waitangituna River *K. V. Bigwood*

EASTERN GREAT WHITE EGRET

of the White Egret in New Zealand is in forest on the banks of the Waitangituna River not far from the Okarito Lagoon. Here, a few miles from the sea, the nests are placed in trees or in the crowns of tree ferns near to or overhanging the water, and at various heights from eight to forty feet. Closely associated in the same colony are nests of the White-throated and Little Pied Shags, much more numerous than the egrets' nests. The nests of the White Egret are strongly built of sticks and are about a foot and a half across. They are in fact platforms with very shallow egg hollows. In one nest, preserved in the Canterbury Museum, sticks and stalks of tree fern leaves are interwoven to make a strong platform and smaller sticks are used to finish it on top. Three to four, sometimes five, eggs are laid in September or October and the young are ready to fly in December and January. When he discovered the White Egret colony in 1865 Mueller counted more than fifty birds. Six years later Potts found twenty-five nests but five years after this Hamilton saw only five nests. There are no further records until 1941 when there were four nests. From then on the numbers gradually increased until at the present time the average number of broods reared each season is twelve, the average number of chicks for each brood raised to maturity being less than two.

Maori. The plumes of the White Egret were highly prized by the Maoris in former times. They were used to adorn the heads of chieftains both in life and after death. Very elaborately carved boxes were made to hold the feathers of the Huia and Kotuku. The Kotuku was kept alive by the Maoris in cages of basket-work, often so small that the bird could not stand upright in them. Small fresh-water fish were given as food and at intervals the plumes were plucked from the unhappy birds.

The Southern Maoris, states Cowan, say that the Kotuku is an inhabitant of the nether world, the spirit land of the Reinga, and that an old funeral lament ends with these words to the departed: "Ko to kotuku to tapui, e Tama—e" (The White Egret is now thy sole companion, O my son!) So seldom does the White Egret appear in any locality that "rare as the Kotuku" has passed into a proverb among the Maoris, while in the North Island it is said to occur only once in a lifetime (He kotuku rerenga tahi).

References.—Linne, Syst. Nat., Ed. 10, 144, 1758 (*Ardea alba,* Europe). Gray, Zool. Misc., 19, 1831 (*Ardea modesta,* India). Buller, Birds N.Z., 226, 1872; 2nd ed., 2, 124, col. pl. 1888; Suppl., 1, 194, 1905. Mathews and Iredale, Ibis, 1913, 404 (*Herodias alba maoriana*). Clark, N.Z. Bird Notes, 3, 328, 1950.

Little Egret

Egretta garzetta nigripes

The Little Egret is admitted to the New Zealand avifauna on the evidence of several records which, however, may possibly all refer to only three birds. A bird was seen by D. H. Brathwaite frequenting the Ahuriri Lagoon during June to September, 1951. It was again seen in the same locality in December of the same year and on the bed of the Tukituki River a few miles away in June and July, 1952. A similar bird was seen at Lake Ryan near Greymouth and near Westport in July, 1952. In all cases except near Westport the Little Egret was associating with Great White Egrets.

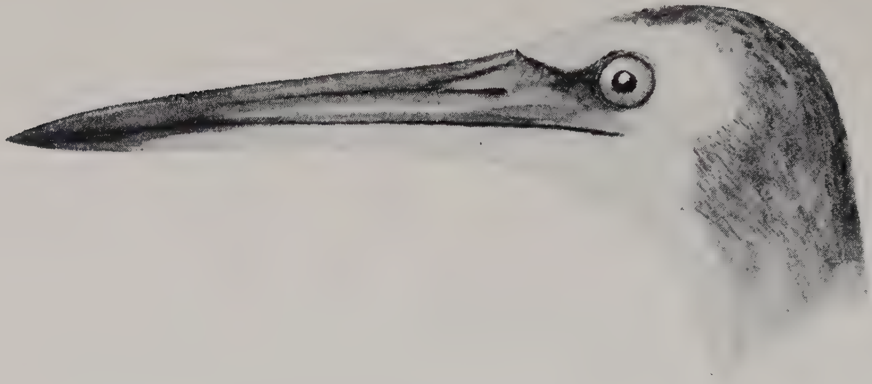
Adult. Entirely white. Two long plumes from nape and large plumes on back and smaller ones on lower foreneck. Bare skin on face and base of bill yellow; remainder of bill black. Iris yellow. Feet black, green at back. Bill 73-95, wing 246-274, tail 81-94, tarsus 90-109 mm.

Eggs. Clutch four, pale bluish green, 46 x 35 mm. Australia.

Distribution. Rangaunu Ray, Onehunga, Ahuriri Lagoon. Tukituki River. Lake Ryan. Westport. All sight records.

Philippines, Malay Archipelago and New Guinea. Other subspecies in Europe, Asia, Africa, Australia.

References.—Linne, Syst. Nat., ed. 12, 237, 1766 (*Ardea garzetta,* Europe). Brathwaite, Notornis, 5, 78, 1952.



C. McCann

WHITE-FACED HERON

GENUS NOTOPHOYX

Bill shorter than tarsus, not serrated; upper mandible notched near the tip. A crest but no nape plumes. Dorsal train of lanceolate plumes, not extending beyond the tail. Breast plumes lanceolate. Tail feathers 12.

Distinguished from Demigretta by the presence of a crest and dorsal train and by the proportionately longer tarsus. Notophoyx comprises three species: *N. novae-hollandiae*, Celebes to Australia, Tasmania and New Zealand; *N. pacifica*, Australia, Tasmania and New Zealand; *N. picata*, Celebes to Northern Australia.

Key to New Zealand Species

Head with white on face and throat only	*N. novaehollandiae*
Head and neck white	*N. pacifica*

References.—Sharpe, Bull. Br. Orn. Club, 5, pp. 11, 13, 1895 (*Notophoyx*, type *Ardea novaehollandiae*, Lath.).

White-faced Heron. Matuku-moana

Notophoyx novaehollandiae novaehollandiae

This widely distributed species, which was described from New South Wales as far back as 1790, was first listed from New Zealand by Buller in 1865, several specimens having been obtained in the North Island. It was, however, known to be in the Nelson district about that time.

Adult. A band of white across the forehead, over and behind the eyes and joining the white throat and chin; crown dark bluish grey, the occipital feathers elongated and lighter; neck and remainder of upper surface light grey with a purplish tinge; long lanceolate plumes of a lighter colour on the back. Quills and tail feathers dark slaty grey. A stripe of buff down the foreneck; breast with elongated purplish plumes; under surface greyish brown tinged with purple. Bill black, the lower mandible whitish towards the base. Iris yellow. Skin between eyes and bill greenish yellow. Feet greenish yellow, claws pale brown. Bill 72-85, wing 305-325, tail 120-130, tarsus 90-108, mid toe 62-70 mm. Several cases of this species having pink or light red legs are recorded by Mrs. L. E. Walker from Otago. *Immature.* Differs from the adult in having more white on the head and neck, more brown on the under surface, purplish tint on breast absent, and scanty dorsal plumes.

Eggs. Clutch four or five, elliptic, pale bluish green 48.5 x 34, 47 x 33.5 mm. Tasmania.

Status. N. novae-hollandiae is readily distinguished from the other species of the genus by the pattern of the white on the head, namely, a band across the forehead over and behind the eyes joining up with a white throat and chin.

All members of the species are referred to the typical subspecies except those inhabiting New Caledonia and the Lifu Islands which are referred to the subspecies *N. n. nana,* distinguished by its smaller size.

Distribution. Fairly plentiful in Westland and Nelson, elsewhere sparingly distributed, mostly in coastal districts of the North and South Islands. Localities where it has been observed include Parengarenga Harbour, Rangaunu, Manukau Harbour, Firth of Thames, Tauranga, Lake Taupo, Gisborne, Ahuriri Lagoon, Waipawa, Pihama, Wanganui, Moutoa, Lake Wairarapa, Porirua, Hutt River, Takaka, Aorere River, Karamea River, Kaiapoi, Lake Ellesmere, Shag River, Otago Peninsula, Awarua Plain, Harihari, Okarito, Big Bay, Jackson Bay, Dusky Sound and Campbell Island (straggler). Known to breed at Porirua, Takaka, Big Bay (Westland), Waikuku (Canterbury) and Shag River.

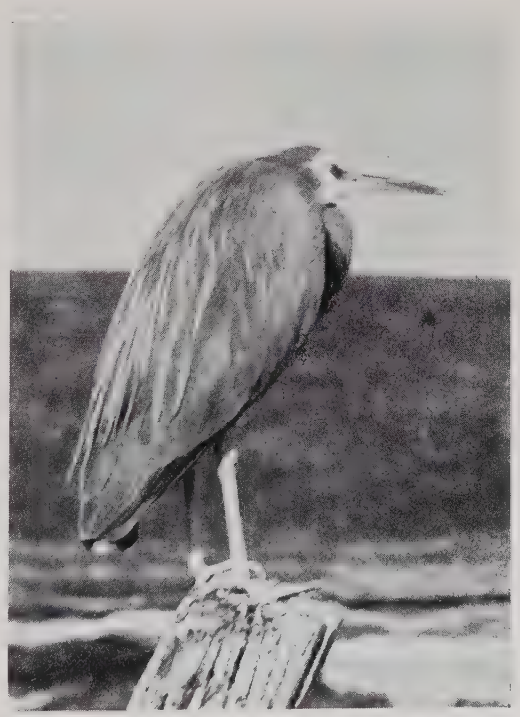
Celebes, Lesser Sunda Islands, New Guinea, Australia, Tasmania.

Habitat. The usual stations for the White-faced Heron are lakes, swamps, mud flats and sandy beaches within harbours and river estuaries, and mangrove swamps.

Food. The White-faced Heron feeds on small fishes, including smelts and whitebait, shrimps, crabs, insects and the introduced frog. When fishing it stands still in shallow water and suddenly strikes with its bill small fishes as they come within reach. In the Shag Valley B. A. Ellis records this: "I watched, after a very careful approach, the herons feeding at a pond in the hills. The birds would wade knee deep in the water with wary and measured step then swiftly lunge their beaks into the grasses and usually, though not always, lift up a kicking frog, which, after a peck or two, was devoured."

Nesting. The only published account of the nesting of the White-faced Heron in New Zealand is that by B. A. Ellis which I here quote: "The white-faced heron is not an uncommon bird in the lower Shag Valley. About the spring of 1941 a pair of herons was noticed in the vicinity, and they chose for their nesting site one of the many bluegums surrounding a homestead, and only a few hundred yards from a creek where food was obtained during nesting. Here they successfully reared a family of two, and so have annually returned to this location to nest. It has been noticed that the young are permitted to remain until the next season, when they are driven off by the original pair.

"Nesting begins in October and, for the last three years two young herons have been flying by early December. This season (1945) was the only one in which a second nest was built, apparently as the first was marauded, one downy young bird being found dead beneath the tree. I climbed to this second nest, with the disappointing knowledge that the two young had left only two or three days before (about 15th January). It was built about 60-70 feet up next to the trunk of a macrocarpa tree which stood among bluegums, and consisted entirely of dry bluegum twigs—mostly about



Manukau Harbour *D. A. Urquhart*

WHITE-FACED HERON

a foot long and a little thinner than a lead pencil. It was about one foot six across, and nearly nine inches deep, and built rather like a pigeon's nest, only more cup-shaped."

Several nests of the White-faced Heron have been reported from the Nelson district and recently Mr. L. A. Shand found one near a swamp at Waikuku, Canterbury. It was placed in a tree at a height of about twenty feet from the ground and was loosely built of sticks. It contained two young nearly ready to fly (February).

References.—Latham, Ind. Orn., 2, 701, 1790 (*Ardea novaehollandiae,* New South Wales). Buller, Birds N.Z., 231, col. pl., 1872; 2nd ed. 2, 134, 1888. Ellis, N.Z. Bird Notes, 1, 109, 1945; Notornis 6, 22, 1954. Lindsay, N.Z. Bird Notes, 2, 123, 1947.

White-necked Heron

Notophoyx pacifica

A White-necked Heron was observed near Methven by J. T. Oram in April, 1952. It was still there at the end of July following.

Adult. Head and neck pale vinous grey to buffy white, sometimes with an irregular double line of dark spots down the middle of the foreneck; upper surface glossy olive green, the lanceolate feathers on the shoulders maroon tipped with slate; edge of wing around carpel flexure white. Long lanceolate feathers on lower foreneck white tipped with buff. Sides of body deep slate; remainder of under surface blackish streaked with white. Bill black, the basal half of the under mandible yellow. Iris green. Feet black. Bill 83, wing 400, tail 170, tarsus 135 mm. *Immature.* Head grey; upper surface dark grey; throat heavily spotted with black; under surface blackish grey streaked with white.

Eggs. Clutch four or five, light bluish green, 50 x 40, 51 x 40 mm. Australia.

Status. Distinguished by the whitish head and neck and the olive green upper surface.

Distribution. Methven. One bird took up its residence there in 1952.

Australia, Tasmania.

Habits. In Australia the White-necked Heron frequents swamps where it may be seen in company with other wading birds. Its nest is a loosely constructed platform of sticks placed in a tree overhanging water or standing in a lagoon. Mr. Oram states that "the bird flies short distances with the neck outstretched but when in full flight the head is drawn back and the legs trailed out behind."

References.—Latham, Ind. Orn. Suppl. 65, 1801 (*Ardea pacifica,* New South Wales). Stidolph, Notornis, 5, 38, 1952.

GENUS NYCTICORAX

Bill stout, about equal to tarsus, higher than broad, not serrated, upper mandible with notch at tip. Two or three long nuchal plumes. Tail feathers 12.

The very stout bill and slender toes with short claws, as well as the nuchal plumes, are distinctive characters.

Nycticorax is a cosmopolitan genus consisting of eleven subspecies grouped in two species.

Reference.—Forster, Syn. Nat. Br. Birds, 59, 1817 (*Nycticorax,* type *Ardea nycticorax* L.).

Rufous Night Heron

Nycticorax caledonicus caledonicus

This beautiful species, whose domain extends from Australia to the Solomon Islands, is only a straggler to New Zealand. Colenso described a Night Heron he saw near Maungatautari on the lower Waikato in 1845. Some birds were introduced by Sir George Grey in 1852 and liberated near Wellington. The species did not become established and it is not certain whether the specimen shot near Wellington in 1856 was one of the imported birds or a straggler from Australia.

Adult. Crown of head and nape glossy black; three occipital plumes 15 cm. long, rolled in the form of a pointed queue, white with brown shafts; upper surface and sides of neck chestnut-red. Superciliary streak, sides of face and under surface white; on the sides of neck and lower part of body the chestnut and white are blended. Bill black, base of lower mandible horn coloured. Iris orange. Skin between eyes and bill greenish yellow. Feet yellow, claws dark brown. Bill 75, wing 295, tail 90, tarsus 90, mid toe 83 mm. *Immature.* Brown, each feather tipped or striped with pale buff, white or cinnamon, giving a mottled appearance. Chin and throat white, breast and abdomen white, streaked with brown. Primaries, secondaries and tail feathers chestnut-red tipped with buff. Bill grey, the culmen dark brown. Iris yellow. Feet greenish yellow, toes brown.

Eggs. Clutch four, ovoid, pale bluish green, 50 x 35 mm. Tasmania.

Status. Several subspecies of *N. caledonicus* have been defined, the New Zealand stragglers being assigned to the typical subspecies (*N. c. caledonicus*) which ranges over New Caledonia and Australia.

Distribution. Introduced and accidental. Liberated near Wellington in 1852, not certainly reported afterwards. Nine occurrences, some being sight records: Maungatautari, Taranaki, Pahaoa River, Wellington, Lake Ellesmere (immature), Hokitika, Okarito, Catlins River, Awarua plain.

Australia, Tasmania, New Caledonia. Accidental in Lord Howe Island.

Habits. The Rufous Night Heron is a nocturnal species inhabiting swamps and lagoons. During the daytime it sleeps in lofty trees. Its nest consists of a platform of sticks placed in a tree standing in water.

References.—Gmelin, Syst. Nat. 626, 1789 (*Ardea Caledonica,* New Caledonia). Buller, Birds N.Z., 233, 1872; 2nd ed., 2, 139, 1888.

GENUS DEMIGRETTA

Bill equal to or longer than tarsus, not serrated; upper mandible notched near the tip. Elongated feathers on head, back and breast, some of those on the back plume-like, that is, without barbs.

There are two or three species ranging from West Africa to the eastern Pacific.

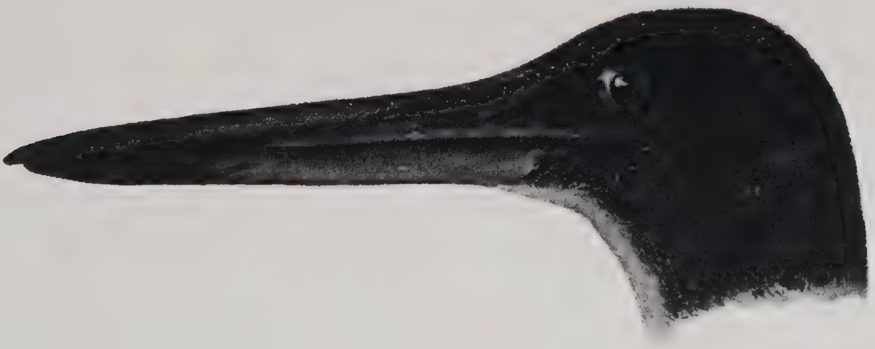
Reference.—Blyth, Journ. As. Soc. Beng., 15, 372, 1846 (*Demigretta,* type *Ardea sacra* Gmel.).

Blue Reef Heron. Matuku-moana

Demigretta matook (semispecies)

The Blue Reef Heron was met with at Queen Charlotte Sound in 1773 during Cook's second voyage. It was described as *Ardea matook* by Vieillot, who took his name from Forster's rendering of the Maori name of the bird. Little more is heard of the species until Buller included it in his Essay in 1865, and Hutton found it at the Great Barrier Island in 1868.

Adult. General colour dark slaty grey, darker on the upper surface, tinged on the lower surface with brown. Chin and front of throat white. Sometimes this white patch extends down the foreneck. Back ornamented with narrow lanceolate bluish grey feathers; a few similar feathers on the breast. Bill dark yellow, shaded with brown on the culmen and sides, horn coloured at the tip. Iris yellow. Skin between bill and eye greenish yellow. Feet greenish yellow, claws brown. Bill 80-92, wing 285-295, tail 100-108, tarsus 76-90, mid toe 65-70 mm. *Immature.* General colour ashy brown. No



C. McCann

BLUE REEF HERON

plumes. Bill dark brown. Feet yellow. *Nestling.* Sparingly covered with slate-coloured down.

Eggs. Clutch two to three, occasionally four, elliptic, pointed at both ends, pale greenish blue, 48 x 36, 48 x 40 mm. Castlepoint. 46 x 32, 48.5 x 34, 51 x 34 mm. Rabbit Island near Tauranga.

Status. The species *sacra* as generally accepted comprises a slate form, a white form, and birds of intermediate or mixed plumage. In New Caledonia is a larger variety of the slate form. According to present day practice the large dark form of New Caledonia is one subspecies and all the others, slate, white and mixed, constitute a second subspecies. In my opinion colour is more important for taxonomic purposes than size so I would treat the New Caledonian slate form as allied to the ordinary slate form. Mayr says that in New Caledonia White Reef Herons are rare. It would be interesting to know whether they are of similar size to the slate birds of the same region. This might be a crucial point to test whether size or colour is the more important. In my view there are two end points in the evolution of the Reef Heron, namely, slate and white, with hybrids between them. This position is exactly as in *Puffinus pacificus.* Each of the slate and white forms breed among themselves and thus behave as distinct species and they have different areas of distribution. In the future they may diverge physiologically and then pass another of the tests of specific distinction. In New Zealand all Reef Herons, except one white example believed to be a straggler, are slate. At Cape York white birds are reported to be "far more numerous" than slate ones. Consequently there is every justification for treating the two colour phases of the Reef Heron as of equal status. But as they habitually interbreed when living in the same locality they must be more closely allied than is usual with species in nature. These facts may be taken into consideration when deciding their taxonomic status. We are accustomed to call the Blue Reef Heron *sacra* and speak of it having a white phase. But actually Gmelin introduced *sacra* for a white bird with some dark feathers here and there, perhaps a hybrid near the pure white form. So it would be equally in order to say that the Reef Heron was a white species with a dark phase. The name *matook* was given to a pure slate bird. For the white form we can use *sacra,* ignoring the few brown feathers which might disappear with age. Mathews gave each form specific rank, treating the birds of intermediate colours as hybrids. They would better be classed as semispecies and thus given the same status as the melanistic semispecies in New Zealand.

Distribution. Common all along the coasts of the North and South Islands, entering harbours. It has been observed at Mokohinau, Great Barrier Island, Hen Island, Karewa, Kapiti, D'Urville Island. Stewart Island and the Chatham Islands. Straggler to Auckland Islands.

Asiatic coast from Burma to Japan, Malay Archipelago, New Guinea, Australia, Tasmania, Islands of the Pacific eastward to the Tuamotu Archipelago.

Habitat. The Reef Heron or, as it is commonly called in New Zealand, the Blue Heron, is to be found along all sheltered rocky coasts. It seems especially to frequent offlying islands and rocks where it makes its nest. It is to be seen inside harbours and estuaries where it frequents tidal mud flats and sandy beaches as well as rocky shores. It comes quite close to the larger cities; in fact, it may sometimes be seen resting on the stringers under the wharves, and it may be seen near the main highways where they run along the shore as in Wellington Harbour. When disturbed it flies slowly out from the shore and returns to another spot generally not far away. Its flight is performed by regular slow flappings of the wings and it usually keeps three or four feet above the water.

Food. The Reef Heron subsists on fishes and on marine animals, mostly crustacea and mollusca, which it finds on the shore be-

Wainui Inlet, Nelson District *H. Guthrie-Smith*

BLUE REEF HERON

tween tide marks. Mr. Sladden informs me that it feeds largely on small flat fishes. The fish are fed to the young birds in a comparatively fresh condition. At Lake Brunner the Reef Heron is reported to feed on eels and greyling. Its method of feeding in tidal pools in the Marlborough Sounds is thus described by Stidolph: On the mud flats it searches the shallow pools in which small fish are often imprisoned, and with a gait that clearly indicates that the bird means business it walks smartly and occasionally runs from one end of the pool to the other, there is a sharp thrust of the bill and the capture is effected. The possibilities of a particular pool having become exhausted the heron stretches its neck, takes flight with legs dangling, draws its neck backward, outstretches its legs, and proceeds to a more fruitful area. In this way it works pool after pool until its needs are met.

Nesting. The nest of the Reef Heron is usually placed in a cave on the sea coast or on a small islet. It is a large structure, three or four feet across, built of large and small sticks with a well shaped hollow about fifteen inches in diameter. Usually it is only a few feet above high-tide mark, but a nest was found on Kapiti Island thirty feet above the sea. On a few occasions the Reef Heron has been discovered nesting in trees. Stidolph records this habit in Queen Charlotte Sound. "In one particular reach of the sound several nests, new and old, were found, all built on the boughs of trees overhanging the water. The places selected were the darkest and gloomiest ones in the vicinity, as it appears to be a failing of the heron that it must have as dark a retreat as it can find for its nest. One occupied nest, placed in a horizontal branch of a matipo, six feet above the water, contained four fledged young, which scrambled out of the nest and hid under a bough. Another nest was as high as fourteen or fifteen feet above high water mark and was actually located over land, though just on the edge of the shore-line. This nest, built of rough sticks and having the cup finished off with finer material, was fourteen inches in diameter and contained three beautiful blue-green eggs." The Reef Heron has been recorded nesting in pohutukawa trees at Clevedon and Parua Bay.

The breeding period is a long one, extending over perhaps six months of the year, and consequently fresh eggs and young birds ready to fly are often found in the same locality at the same time. The egg-laying period is mainly September to December.

References.—Vieillot, Nouv. Dict. Hist. Nat., 14, 416, 1817 (*A. matook,* New Zealand). Buller, Birds N.Z., 228, col. pl., 1872; 2nd ed., 2, 129, col. pl. 1888. Sharpe, Cat. Birds Br. Mus., 26, 137, 1898. Guthrie-Smith, Sorrows Joys N.Z. Nat., 77, 1936. Mathews, Birds Austr., 3, 450, 1914. Mayr and Amadon, Amer. Mus. Nov., no. 1144, 1941.

White Reef Heron

Demigretta sacra (semispecies)

The White Reef Heron was met with at Tahiti during Cook's second voyage. In April, 1944, a White Reef Heron was observed by K. A. Wodzicki and J. R. Eyles at the mouth of the Wairau River. These observers judged the bird to be at least a year old. It did not associate with the slate birds and these two circumstances suggest that it was a straggler from the Pacific. It remained in or about the same locality for more than a year.

Adult. The following description of the Wairau bird is given by Wodzicki and Eyles: The plumage is entirely white; the bill is dusky blue from the tip to almost two-thirds the distance to its base, merging into greenish-yellow and, near the eyes, into dark yellow. The iris, which normally is yellow, is in our bird silver-grey. Finally the legs, which are normally greenish-yellow, are, in our specimen, greenish blue in their upper parts and pale yellow nearer the foot.

Status. Mathews says that the White Reef Heron breeds true: "When it does interbreed we find recorded pure white and dark young in the nest, all dark young, or all pure white in the nest." The populations of Reef Herons other than in New Zealand include white birds in varying proportions. Mayr gives the following figures: Samoa 25 per cent. or fewer, Fiji-Tonga 20 per cent., Solomon Islands 25 per cent., Santa Cruz 27 per cent., Micronesia and New Caledonia rare. At Cape York, states Thomson, the white form is far more numerous than the grey. In the south-west Pacific according to Mayr a small proportion, five to fifteen per cent., are mottled grey and white. The mottled birds are presumably hybrids between birds of the two colour forms, but Mayr thinks that most of them are immatures of the white birds.

In the Capricorn group R. P. Cooper found white herons outnumbering blue ones by about ten to one, and that the two kinds kept to themselves for breeding. MacGillivray, however, noted white paired with blue in two cases.

Distribution. Wairau River mouth, a single bird, 1944-1945.

Same distribution outside New Zealand as Blue Reef Heron.

Habits. Quoting Wodzicki and Eyles: A normal Reef Heron was present in the Wairau Bar area during the whole month of December, 1944, but the two phases did not associate at any time during their joint presence at the bar. In May, 1945, a Kotuku, or White Egret (*Egretta alba*) appeared for the first time in the last few years at the bar, and both birds have been observed feeding together in the same lagoons. It roosted at different places, mostly on the breakwater, but changed its place of abode from one lagoon to another according to the presence of whitebait or shoals of small fish. When disturbed it uttered several harsh croaking sounds in quick succession (half a second each). During its stay at Wairau Bar it was frequently attacked by Red-billed Gulls and once by a pair of Pied Oystercatchers. These attacks did not cause the bird to give up its place, but often it made a dart at them with the bill, which it always pointed skywards when the bird was attacked.

References.—Gmelin, Syst. Nat., 640, 1789 (*Ardea sacra,* Tahiti). Wodzicki and Eyles, Emu, 44, 181, 1945; N.Z. Bird Notes, 1, 115, 1946.

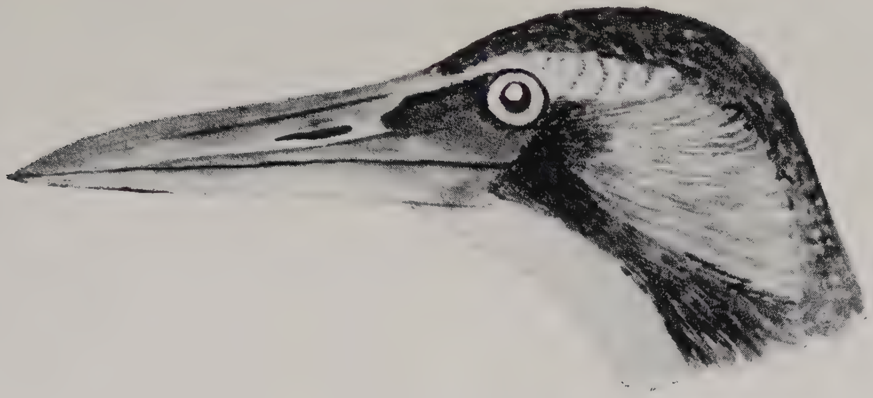
GENUS BOTAURUS

Bill shorter than tarsus, serrated. Middle toe and claw longer than tarsus; hind claw very long. Tail feathers 10.

The short stout bill and long toes with very long claws are distinguishing characters.

Four species divide the world among them, their areas of distribution not overlapping.

Reference.—Stephens, Shaw's Gen. Zool., 11, 59, 1819 (*Botaurus,* type *Ardea stellaris* L.).


C. McCann

BROWN BITTERN

Brown Bittern. Matuku-kurepo

Botaurus poiciloptilus

The Brown Bittern, or as it is usually called, the Bittern, was first collected in New South Wales, whence specimens were described by Wagler in 1827. It was recorded from the Bay of Islands by Yate in 1835 and by Colenso in 1842. G. R. Gray described it in Dieffenbach's *Travels,* in 1843, from a specimen obtained near the Hokianga River by Miss Stone.

Adult. Crown, nape and line below the eye dark brown. Superciliary streak and ear coverts tawny buff. Upper surface dark brown, the feathers margined and freckled with buff, the buff markings and freckles much reduced on the mantle, scapulars, primaries, secondaries and tail. A smoky brown ruff with buff edgings to the feathers on the sides of the neck. Under surface tawny buff with dark brown markings consisting of variegated bands down the middle or sides of the feathers. Bill dark brown, lighter towards the base. Iris yellow. Skin between eye and bill pale green. Feet pale green. Bill 68-77, wing 350-370, tail 120-130, tarsus 100-110, mid toe 115-133 mm. *Immature.* Plumage paler than in the adult; on the neck cinnamon-brown instead of black markings. *Nestling.* Sparingly covered with long greyish down. *Colour variety.* A partial albino shot at Foxton had large white patches on the head and breast, the rest of the plumage being normal.

Eggs. Clutch three to five, ovoid, pointed one end, greenish cream. 51.2 x 38.5, 52 x 36.8, 53 x 38.8 mm.

Status. The Brown Bittern is allied to the Bittern of the eastern hemisphere, *B. stellaris,* but is more uniformly coloured and is especially distinguished by the smoky brown ruff on the sides of the neck.

Distribution. Generally distributed throughout the North and South Islands, Great Barrier Island and Stewart Island. Kapiti Island, one record. Formerly in the Chatham Islands.

Australia, Tasmania, New Caledonia.

Ecology. The Bittern was formerly found in all swamps and lagoons where there was vegetation consisting of reeds, such as rushes and raupo. In such situations its habit of remaining motionless with its head erect renders it difficult to detect even at close quarters. Through the draining of swamps and advance of settlement the Bittern is retreating but is still to be met with throughout the country.

The very varied and large amount of animal food devoured by the Bittern places it in the list of valuable useful birds not only to the agriculturalist but also as a protector of small birds. It is a destroyer of rats and mice, of insects, and also of eels. Included in its insect diet are crickets, grasshoppers and cutworms. Against the Bittern it should be noted that its food consists partly of young trout.

Food. The Bittern's fare includes a varied assortment of animal foods: insects, crustacea, spiders, fishes, lizards, birds and the introduced frogs, rats and mice. The fish includes eels and other fresh-water fish. Buller records that from the gullet of a Bittern he extracted two headless eels each sixteen inches in length. An interesting account of a Bittern catching an eel is described by S. D. Potter in these words: "I had been watching one from no great distance as it slowly made its way through the water not very far from the bank. Suddenly the bird's long bill plunged into the water, which immediately became churned as an eel some two feet in length was brought into view. Without any delay the bird made for the bank and there proceeded to batter and shake the eel into submission. The captive, however, proved very difficult to subdue, and time and again wound its sinuous coils in a snake-like manner around the bird's neck, a proceeding to which the bittern took strong exception, as on each occasion the elongated neck feathers were ruffed out and a long leg was immediately raised to brush off the slippery coils. Eventually, continued rough treatment overcame the eel's resistance and

G. A. Buddle

IMMATURE BROWN BITTERN

before long its struggles had weakened sufficiently to allow the victor to swallow it head first."

Buller, in recording that he found the remains of a White-eye (Zosterops) in the stomach of a Bittern, remarks that as this species only feeds on living animals it would probably catch the White-eye alive.

Voice. The peculiar booming sound of the Bittern, usually four calls issued in succession, is generally heard in the evenings. From this noise coming from the swamps the Maori name Matuku-ku-repo, that is, the Matuku of the swamps, is derived.

"Booming started in mid-September and finished about February 10. Mostly at night. Pairs calling to one another, deep boom answered by higher-pitched boom." (W. Sanderson, Whangamata). "Actually," write Stidolph, "the bird inclines the bill downward and fluffs out the feathers of the neck and breast when it utters its 'boom.' Although the note does not sound very loud when heard close at hand it has a remarkable carrying power."

Nesting. The nest of the Bittern is a flat structure made of rushes, raupo and such drift-borne sticks as are handy, its top being raised only a few inches above the ground. It is always situated in a swamp well hidden among dense rushes and often on outlying patches surrounded by water or soft mud. Though four is the usual number of eggs laid, five are sometimes found in a nest. The habit of remaining motionless when danger threatens is developed in the young at an early date, for, as Guthrie-Smith expresses it, chicks one to five days old "immediately at sight froze themselves into snags, each little head and bill pointing skywards at an odd angle." The egg-laying period extends from the end of August to about the middle of January.

Uses. Bitterns' feathers are much fancied for the manufacture of artificial flies for trout fishing. Why any other kinds of feathers are not so good for this purpose is not explainable by fishing folk.

References.—Wagler, Syst. Av. Ardea, sp. 28, 1827 (*A. poiciloptila,* New South Wales). Gray, Dieff. Travels N.Z., 2, 196, 1843 (*Botaurus melanotus,* Hokianga). Buller, Birds N.Z., 238, 1872; 2nd ed., 2, 141, col. pl. 1888. Guthrie-Smith, Bird Life, Island and Shore, 89, 1925. Buddle, Bird Secrets, 36, 1951.

GENUS IXOBRYCHUS

Bill equal to tarsus, serrated. Area behind the eye feathered. Tail feathers 10.

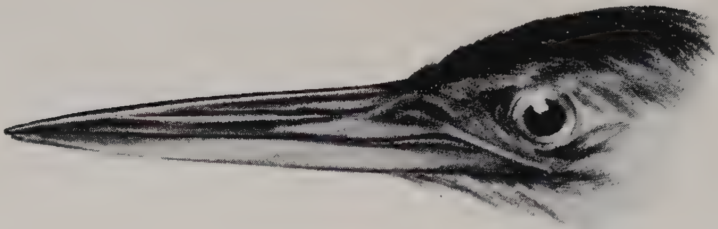
Small birds with slender bills and toes, and short tarsi. Cosmopolitan in distribution, each of the seven species having an extensive range.

References.—Billberg Syn. Faun. Scand., 1, 166, 1828 (*Ixobrychus,* type *Ardea minuta,* L.). Gray, List. Gen. Birds, app. p. 13, 1842

Little Bittern. Kaoriki
Ixobrychus novaezelandiae

This species is seldom seen. The first specimen recorded from New Zealand was obtained at Tauranga in 1836 by Rev. Mr. Stack. No other example has since been obtained in the North Island. In 1868 two birds were taken on the Kanieri River in Westland, and since that date not more than ten specimens have been taken in New Zealand, nearly all being from Westland.

Adult male. Crown and nape greenish black; hindneck chestnut; back and scapulars brown, the feathers edged with rufous. Wings with patch of chestnut at shoulder and carpal flexure; coverts buff with chestnut centres; marginal coverts distad of carpel flexure light buff; quills brown, except the first three tipped with chestnut; innermost secondaries brown with wide chestnut borders. Tail greenish black. Throat buff with chestnut midline; under surface striped chestnut and buff; feathers on sides of breast and flanks brown with wide rufous buff margins; under wing coverts buffy white with brown central streaks; under surface of quills greyish brown. Bill yellowish green, culmen and tip black. Bare skin yellowish green. Iris yellow. Feet yellowish green. Bill 53-56, wing 152-164, tail 51-60, tarsus 50-57, mid toe 57-70 mm. *Adult*



Lily A. Daff

LITTLE BITTERN

female. Crown, nape, hindneck and tail as in male. Feathers on sides of neck brown with rufous buff borders; back and scapulars striped dark brown and buff or chestnut. Chestnut patch on shoulders and carpel flexure; coverts brown with wide buffy borders; greater coverts light chestnut with pale borders; marginal coverts and quills as in male. Chin and throat buffy white with a central line of rufous feathers with brown shaft lines. Rest of under surface striped brown and buffy white, the centres of the feathers being brown. Under surface of wings as in male.

Status. Judging by the specimens of *Ixobrychus* available in New Zealand museums, this species differs from others of the genus more than they differ from each other. I have no hesitation in treating it as a distinct species. It is appreciably larger than *I. minutus,* has not the continuously black back or uniformly buff wing coverts and under surface of that species but is more or less spotted over most of the body.

Distribution. Tauranga, Lake Brunner, Hokitika, Kanieri River, Okarito, Lake Wakatipu, Jackson Bay, Westport.

Habits. The following information relating to the habits of the Little Bittern is taken from the account of Mr. Docherty who observed it in Westland: "They are to be found on the salt-water lagoons on the sea shore, always hugging the timbered side of the same; I have seen them in two positions, viz., standing on the bank of the lagoon with their heads bent forward, studiously watching the water, at other times I have seen them standing straight up. I caught one about two miles in the bush on the bank of a creek, but the creek led to a lagoon. They are always found alone and stand for hours in one place."

In captivity the Little Bittern has eaten mudfish (*Neochanna apoda*) and worms when given to it in water.

References.—Purdie, Proc. N.Z. Inst., 3, 99, 1871 (*Ardeola Novae-Zelandiae,* Lake Wakatipu). Potts, Trans. N.Z. Inst., 3, 97, 1871. Buller, Trans. N.Z. Inst., 6, 119, pl. 1874; Birds N.Z., 235, 1872; 2nd ed., 2, 136, 1888.

FAMILY PLEGADIDAE. IBISES

Bill much curved, considerably longer than tarsus; nasal groove linear and produced to the tip of the bill.

Key to New Zealand Genera

Head and neck bare. Tarsus reticulated in front	*Threskiornis*
Face and chin only bare. Tarsus plated in front	*Plegadis*

Genus Threskiornis

Entire head, throat and neck all round bare. Inner secondaries ornamental, dependent, with the webs of the feathers disconnected. Tarsus reticulated in front with hexagonal scales.

A single species widely distributed over Africa, Asia and Australia. Accidental in New Zealand.

References.—Gray, App. List Gen. Birds, 13, 1842 (*Threskiornis,* type *Tantalus aethiopicus* Lath.).

Australian White Ibis

Threskiornis aethiopica strictipennis

The Australian White Ibis is a comparatively recent addition to the birds of New Zealand. In March, 1925, a strange bird was seen on the mudflats at Appleby, near Nelson. About a week after its arrival, Mr. M. Rogers saw it feeding on the mudflats but on his approach it flew into a tree, from which it descended but returned again at sunset. While resting here it was caught with a noose on a long stick by Mr. Rogers' son. Shortly after this specimen was caught, other White Ibises were seen in several other localities in Westland, Nelson and Taranaki, so that it would appear that a small flock must have crossed the Tasman Sea.

Adult. Head and upper half of neck bare. On the foreneck some elongated, narrow drooping plumes. General plumage white; primaries broadly tipped with blue-black; inner secondaries mottled with purplish black, the innermost having the webs disconnected and entirely purplish black. Bill slaty black. Iris dark brown. Bare portion of head and neck slaty black, crowned at back with ten narrow bands of rose-pink, and on the crown of the head a star-shaped series of oval spots of the same colour. Tibia and tarsal joint deep purple; tarsus and foot light purple. Bill 190, wing 370, tail 130, tarsus 110 mm. *Immature.* The part of the neck which is bare in the adult is covered with white feathers.

Eggs. White, 62 x 46, 66 x 43.5 mm. Northern Australia.

Distribution. During 1925 the White Ibis was observed at Appleby, Greymouth, Riwaka, Rotomanu and in South Taranaki.

Habits. The food of the White Ibis consists of insects, shellfish and crustacea. For breeding, large numbers congregate together in association with the Straw-necked Ibis, and build nests on broken-down rushes and bushes which form a kind of platform over the water in a swamp. Occasionally the White Ibis nests in trees.

References.—Latham, Ind. Orn., 706, 1790 (*Tantalus aethiopicus*). Gould, Syn. Birds Austr., pt. iv, app. 7, 1838 (*Ibis strictipennis,* New South Wales). Moncrieff, N.Z. Journ. Sci. Tech., 7, 371. 1925.

GENUS PLAGADIS

Chin bare, rest of throat feathered; lores bare; cheeks partly bare. Tarsus plated in front with distinct transverse scales.

Three species distributed over the temperate regions of the world.

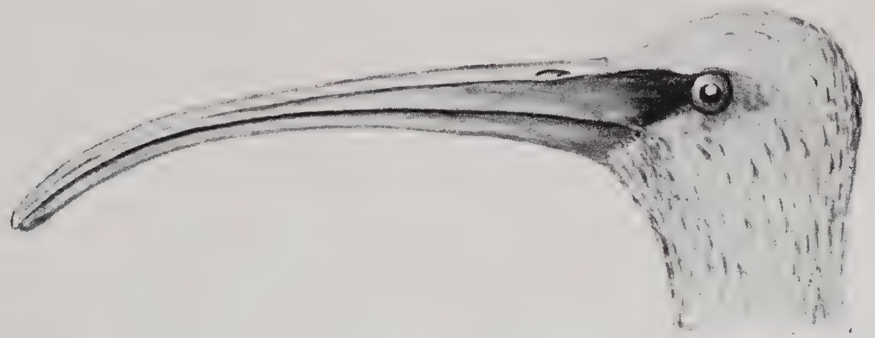
Reference.—Kaup. Skiz. Ent. Ges. Nat. Sys., 82, 1829 (*Plegadis,* type *Tantalus falcinellus* L.).

Glossy Ibis

Plegadis falcinellus peregrinus

This widely distributed subspecies has been obtained in New Zealand on nine occasions. The first specimen was shot at Washdyke Lagoon, near Timaru, in 1902.

Adult. Head, neck all round and under surface deep maroon-chestnut; forehead and fore part of crown glossy green, as also the base of the cheeks and below the eye. Upper surface black with glossy bronzy purple or green reflections; upper mantle, lesser wing


C. McCann

GLOSSY IBIS

coverts, and scapulars deep maroon-chestnut; primaries and their coverts glossy green. Under wing and tail coverts black with green and purple reflections. Bill olive-brown. Iris brown. Line across forehead and from eye to base of lower mandible blue-grey. Feet lead-grey or olive-brown. Bill 126-130, wing 265-280, tail 90-105, tarsus 90-98, mid toe 77-78 mm. In winter the head and neck are streaked with black and whitish, and the chestnut of the upper parts is lost. *Immature.* Similar to the adult in winter but more of a metallic oil-green. Head dusky brown.

Eggs. Clutch four, dark bluish green, 50 x 36, 52 x 36.5 mm. Australia.

Distribution. Makikihi, Rangitikei, Woodville, Foxton, Ohau River mouth, Blenheim, Whangamoa, Harihari, Washdyke Lagoon. Flocks of glossy ibises were seen in the summer of 1953-54 as follows: Dillons Point, Blenheim, November 13th, 16 birds; Invercargill, November 18th to 29th, 24 birds; Dillons Point, December 8th to 21st, 16 birds; Opiki, near Palmerston North, end December to January 8th, 14 birds. It will be noticed that flocks were reported in only one locality at a time, so probably only one flock was involved.

Philippines, Celebes, Sunda Islands, to New Guinea and Australia. Accidental in Tasmania. *P. f. falcinellus* is found in North America, Europe, Asia and Africa.

Habits. Insects, spiders, shellfish and fishes form the food of the Glossy Ibis. The nests are constructed of leafy twigs and placed in trees growing in water and from seven to twenty feet above its surface.

References.—Linne, Syst. Nat., 12th ed., 241, 1766 (*Tantalus falcinellus,* Austria). Bonaparte, Comp. Gen. Av., 2, 159, 1855 (*Ibis peregrina,* Java and Celebes). Bailey, Emu, 33, 279, 1934. Sansom and others, Notornis, 6, 18, 1954.

FAMILY PLATALEIDAE. SPOONBILLS

Head partially or entirely bare, bill flattened, narrow in the middle and widening into a spatulate end. Half of the tibia naked, toes long, bordered by membrane and slightly webbed at the base.

GENUS PLATALEA

Head partially bare; auricular orifice covered with plumes. Nostrils in a shallow depression. A full crest in the breeding season. No ornamental plumes on the breast.

Four species in the Eastern Hemisphere.

Reference.—Linne, Syst. Nat., 10th ed., 139, 1758 (*Platalea,* type *P. leucorodia* L.).

Royal Spoonbill. Kotuku-ngutupapa
Platalea regia

An Australian species recorded on six occasions between 1861 and 1932, and continuously since 1942. Ellman, in 1861, recorded a specimen from Castlepoint. The second specimen was shot in 1876 near the mouth of the Manawatu River by Mr. Blake. It was sitting on the sand in company with three paradise ducks. The bird had been seen for five or six months previously about the lagoons in the vicinity. Between 1942 and the present time Spoonbills have been seen in New Zealand every year, in one instance six together, and since 1950 they have bred. In 1951 and each of the following years two young were reared in the Egret and Shag colony near the Okarito Lagoon. It is possible, therefore, that the present population results from the two birds seen at the Ohau River mouth in 1942. The Royal Spoonbill was known to the Maoris as Kotuku ngutupapa so that it must have occurred in New Zealand on several previous occasions.

Adult. A full crest on the head and occiput. Entire plumage white; a tinge of sandy buff on the foreneck. Bill black; distal half brown. Iris brown. Bare skin on forehead, lores and orbits black; gular pouch leaden brown. A yellow spot above each eye. Bill 203, wing 380, tail 115, tarsus 140, mid toe 108 mm. *Immature.* Differs from the adult in having shorter bill, no crest, and some brown on the primaries.

Eggs. Clutch four, white sparingly marked with brown blotches, mostly near the larger end, 65 x 43.5 mm.

Status. Distinguished from *P. leucorodia* by the whole forehead and region of the eye being bare and black. In *P. leucorodia* the feathering on the crown reaches nearly to the bill, and the throat and space round the eyes are yellow.

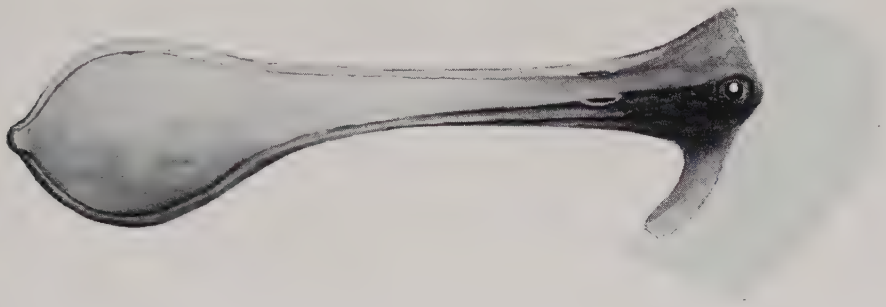
Distribution. 1861-1932. Hokianga, Auckland, Castlepoint, Greytown, Martinborough, Manawatu River mouth, Nelson, Buller River.

1942-1954. Rangaunu Bay, Te Kopuru, Manukau Harbour, Firth of Thames, Patea River mouth, Wanganui River mouth, Waitotara estuary, Manawatu River mouth, several records, six seen by Stidolph May, 1953, Ohau River mouth, Waikanae, Lake Wairarapa, Ashley River, Lake Ellesmere, Westport, Okarito, Paterson Inlet. Breeding at Okarito Lagoon 1951 and afterwards.

Australia. Occasional in New Guinea, Celebes, Timor and Moluccas.

Habits. The Spoonbill feeds on insects, shellfish, small fish and frogs. The nest is sometimes made of sticks and placed in a tree overhanging water, or it is made of reeds in a swamp.

References.—Gould, Syn. Birds Austr., pt. iv, App. p. 7, 1838 (*P. regia,* New South Wales). Buller, Trans. N.Z. Inst., 9, 337, 1877; Birds N.Z., 2nd ed., 2, 144, 1888. Stidolph, N.Z. Bird Notes, 2, 195, 1948.



C. McCann

ROYAL SPOONBILL

ORDER ANATIFORMES

DUCKS, GEESE, SWANS

Bill broad, depressed, laminated within both mandibles. Toes webbed in front. Young covered with down and able to run a few hours after being hatched.

A single family.

FAMILY ANATIDAE

Bill generally broad to the tip, in some (Mergus) it is narrow and more or less tapering to a point; always a distinct nail at the tip; covered with a membrane, except the nail. Toes fully or partly webbed. Hind toe generally elevated, level in some species.

Key to New Zealand Genera

Hind toe narrowly lobed.
  Lower part of tarsus reticulate in front .... *Dendrocygna*
  Lower part of tarsus scutellate in front.
    Tail feathers broad and rounded at tip.
      Bill narrow .... *Chenonetta*
      Bill flattened .... *Casarca*
    Tail feathers pointed at tip.
      Bill not spathulate .... *Anas*
      Bill spathulate .... *Spatula*
Hind toe broadly lobed.
  Bill not serrated, not narrow.
    Bill depressed .... *Aythya*
    Bill compressed .... *Hymenolaimus*
  Bill serrated, narrow .... *Mergus*

Genus Dendrocygna

Bill long, higher than broad at base, a strong nail at tip, lamellae of upper mandible visible. First quill with a deep notch. Lower portion of tarsus reticulate in front. Webs indented. Hind toe long, elevated.

Dendrocygna is distinguished from all the other members of the sub-family Anatinae by the lower front portion of the tarsus being reticulate. Eight species are distributed over the whole world except Polynesia.

Reference.—Wagler, Isis, 1832, p. 281 (*Dendrocygna*, type *Anas arcuata* Cuv.).

Whistling Duck

Dendrocygna eytoni

Only on three occasions has the Whistling Duck been recorded as visiting New Zealand. In May, 1871, a specimen was shot on the Thames River. In June of the same year a flock of fourteen was seen in the neighbourhood of the Tuakitoto and Kaitangata Lakes in Otago and three were shot by W. S. Pillans. The third visitation is recorded by W. W. Smith who states that during the winters of 1894 to 1896, two males and a female inhabited the lakes of the Ashburton Domain, and were fed with the other ducks kept there.

Adult. Head, neck and upper breast yellowish brown, tinged with yellow ochre on top of head, and fading to greyish white on throat; back, rump and upper surface of wings dark ashy brown, some of the feathers of back and scapulars margined with greyish white; upper tail coverts yellowish white broadly tipped with blackish brown; quills and tail feathers coppery brown. Lower breast and sides of body chestnut brown barred with black; long flank plumes yellowish white margined with black; abdomen and under tail coverts white. Bill flesh colour mottled with black, nail brown. Iris yellow. Feet flesh colour. Bill 45, wing 240, tail 80, tarsus 50, mid toe 60 mm.

Eggs. Clutch ten to twelve, ovoid, creamy white, glossy, 49 x 39, 48.5 x 38 mm. Australia.

Distribution. Thames River, Ashburton. Kaitangata Lake.

Australia, Tasmania (visitor).

Habits. The Whistling Duck is a powerful flyer and when on the wing can be recognised by the peculiar shrill whistling sound which it utters. According to A. J. North it is generally met with near swamps and rivers except in the breeding season when it resorts to grassed country away from water. The nest is a hollow in the soil lined with grass and placed in the shelter of a tussock.

References.—Gould, in Eyton's Monogr. Anat., 111, 1838 (*Leptotarsus eytoni,* N.W. Australia). Buller, Birds N.Z., 265, 1872; 2nd ed., 2, 268, 1888.

GENUS CHENONETTA

Bill goose-like, short, narrow, smooth. Lower part of tarsus scutellate in front. Tail feathers broad and rounded. Legs rather long; hind toe narrowly lobed.

A somewhat isolated genus of ducks usually included in a subfamily by itself, but Mayr associates it with the mandarin duck, pygmy goose, Muscovy duck and others in the tribe Cairinini. Judged by cranial characters *Chenonetta* comes close to the extinct New Zealand duck *Euryanas,* both showing similar primitive characteristics.

Reference.—Brandt, Desc. Icon. Anim. Russ. Nov. Aves, fasc. 1, p. 15, 1836 (*Chenonetta,* type *Anas jubata* Lath.).

Australian Wood Duck or Maned Goose
Chenonetta jubata

The Wood Duck has been recorded in New Zealand on four occasions only, all in the south of the South Island. One was shot at Lake Glendhu, Wanaka, in 1910 and a second one, a female, was shot by Mr. N. Shaw in the Orawia district, Waiau River, Southland, in May, 1944. Both these specimens are in the Otago Museum. It was reported also that two other birds were shot about the same time, one at Linwood, the other at Wairaki.

Adult male. Head and neck reddish brown becoming blackish on the nuchal crest or mane; a narrow white line below the eye. Mantle dark grey with a black spot on each side of the feathers. Upper back and scapulars pale grey; lower back, rump, upper tail coverts and tail glossy black. Wing coverts grey, the greater coverts broadly tipped with white; primary coverts and primaries brownish black. Secondaries with glossy green band on outer webs and broad white tip. The green speculum thus has a white band above and below it. Axillaries and under wing coverts white. Sides and flanks greyish white with fine wavy black cross lines. Foreneck and breast white barred with brown with a black spot on each side of the feathers. Middle of abdomen and under tail coverts black. Bill dark green; iris dark brown; legs and feet dark greenish grey. Bill 30, wing 273, tail 93, tarsus 51 mm. *Adult female.* Head and neck paler brown, streaks above and below eye, chin and upper throat speckled; sides without wavy black lines; abdomen and under tail coverts white. Remainder much as in male but speculum duller green. *Nestling.* Upper surface brown, head darker; white stripe above and below the eye; dark brown stripe from bill through eye, and another below the white one; white bar on wing; white spot on each side of back near tail; under surface white. Feet greenish.

Eggs. Clutch nine-twelve, oval, glossy, creamy white. 57 x 40.4, 56.4 x 41.4, 57.4 x 40.2, 57.6 x 41.4 mm. Australia.

Distribution. Four occurrences in Otago and Southland. Lake Glendhu (Wanaka), Orawia, Linwood, Wairaki.

Australia, Tasmania.

Habits. Little has been recorded of the Wood Duck in Australia. It is not so common as formerly. It associates in large flocks which are inquisitive enough to approach human beings. It is a pasture feeder. The nest of the Wood Duck is placed in a hole or hollow spout of a tree either near or standing in water. It is well lined with down.

The Wood Duck is recorded as being very destructive to grown crops. The first crop of rice, 18 acres, grown in Victoria for commercial purposes was completely destroyed by these birds.

References.—Latham, Ind. Orn. Suppl., 69, 1801 (*Anas jubata,* New South Wales). Mathews, Birds Austr., 4, 53, col. pl. 1914.

GENUS CASARCA

Bill as long as head, width at base equals height, anterior half depressed, nail strong and broad, lamellae of upper mandible prominent. Second quill longest. Tarsus longer than bill; hind toe elevated, lobed.

Casarca is recognised by its large size, short bill and long tarsi. It differs from the European Shelduck, Tadorna, in the bill not widening at the tip, the nearly straight culmen, the lamellae of the upper mandible equally developed and those of the lower mandible projecting outwardly. There are four species occupying different parts of the eastern hemisphere.

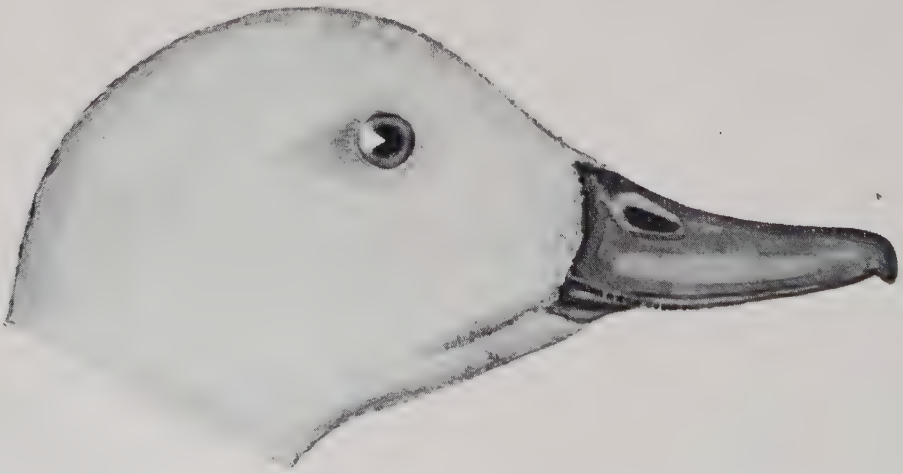
Reference.—Bonaparte, Geogr. Comp. List. Birds, 56, 1838 (*Casarca,* type *Anas ferruginea* Vroeg.).

Paradise Duck. Putangitangi

Casarca variegata

This fine species was discovered at Dusky Sound in 1773 during Cook's second voyage. Cook called it the Painted Duck, but Latham described it as the Variegated Goose and Gmelin converted this to its Latin form for the specific name. J. R. Forster who accompanied Cook stated that it was always seen in pairs and frequented the mouths of rivers. It was encountered by Dieffenbach in the North Island and by Earl in the South Island about 1840, Earl stating that it breeds near the sea shore and at the approach of danger runs with its young into the surf.

Adult Male. Head and upper neck black with bluish green reflections; neck below and upper breast dark brown minutely freckled with pale rufous; back, scapulars, lower breast and sides of body, black, mottled and marked with white wavy lines; wing coverts white; primaries black, secondaries green on exposed webs forming a bright speculum, dusky and margined with white on the inner webs; inner secondaries with outer webs rufous, inner webs cinereous freckled with white. Abdomen dark rufous spotted and barred with black; under tail coverts ferruginous with darker stains; under surface of wings white. Bill black. Iris black. Feet greyish black. Bill 40-44, wing 350-370, tail 125-150, tarsus 60-70, mid toe 55-68 mm. *Adult Female.* Head and upper part of neck white; lower neck, back, scapulars, breast and abdomen, chestnut, waved and freckled with black and white lines; remainder as in male. *Immature.* Sexes alike:



E. H. Atkinson

PARADISE DUCK

resembles the adult male. *Nestling.* White; top of head, broad mark down back, patch on wings and flanks umber brown. *Colour variety.* A bird taken at Milford Sound is white variegated with umber brown, the brown being on the head above the eye, a strip from hind neck to tail widest on the upper back, on the front and tip of the wings and a large patch on each flank. There is also a broad band of pale brown underneath from wing to wing.

Eggs. Clutch five to eleven, nearly elliptical, yellowish cream colour, 68 x 49.5, 65.5 x 51.5 mm. Manuka Point.

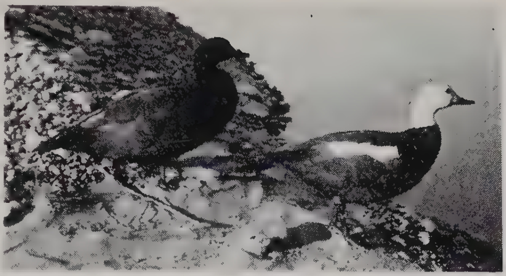
Distribution. In the North Island now found mainly from Lake Rotomahana, Lake Waikaremoana and the East Cape district southwards but not generally distributed. There is a record for the north of Auckland about 1870. Recently birds have been seen on Manukau Harbour, Firth of Thames and in the Bay of Plenty and these may be signs of its spreading gradually northward. But its chances of establishing itself in the settled districts are considerably lessened by the attention of sportsmen. Birds introduced to Lake Rotomahana were shot out in a very short time. It is increasing in protected areas even close to towns such as Ahuriri Lagoon near Napier. Transferred to Kapiti, 1931, and to Kawau Island by Sir George Grey.

Formerly abundant throughout the South Island, now more restricted owing to the advance of settlement, though persisting in lagoons near towns such as Washdyke near Timaru. In south Westland large flocks are still to be seen in the moulting season. Stewart Island.

Semi-fossil in Moa Bone Point Cave, Banks Peninsula, and Pyramid Valley.

Straggler to Lord Howe Island.

Habits. The Paradise Duck is both a freshwater and a coastal species. Its domain includes the mountain streams and river beds, the open grassy plains and downs of the lowlands, especially in the vicinity of rivers and lakes, and the sea coast and coastal waters. It is generally found in pairs, as Forster observed in 1773, but moves from place to place in large flocks. In the moulting season when they are unable to fly, large numbers congregate on sand banks in lakes. The Paradise Duck dives well, using its wings when beneath the surface.



K. V. Bigwood

PARADISE DUCK MALE AND FEMALE

Food. The food consists mainly of soft grass and herbs, but insects are caught and crustacea taken in the coastal waters. The young are at first fed on insects or crustacea.

Voice. In uttering their usual calls both sexes hold their heads up, the male issuing a prolonged guttural note and the female a shrill call. When provoked, the male hisses like a goose. The calls are uttered both on the ground and when flying.

Nesting. Various sites are selected by the Paradise Duck for its nest. Usually it is placed on the ground well hidden beneath a tussock or in a hole in a rock, and near water. Sometimes, however, it is built in a tree, fifteen to twenty feet from the ground, and it has been found on mountain faces far from water. The nest is built of grass and lined with down which the female plucks from her own body. The usual breeding season is from August to January and two broods are often reared.

Incubation, which takes 34 days, is said to be carried out by the female though both parents share the responsibilities of rearing the ducklings, which, on hatching, are led almost immediately to the water. The way paradise ducklings reach the ground from a nest in a tree was recently observed by Mr. J. Ollerenshaw near Lake Ohau. He states that the parents called from the ground and the ducklings one by one launched themselves from the edge of the nesting hole and landed on the ground apparently unhurt. Potts states that the young are at first fed by the parents on insects or crustacea but they soon learn to eat herbage themselves. When danger threatens the parents give a warning signal at which the young usually make for the water. The device of luring enemies away from the nest by feigning lameness is also resorted to. An interesting account of the life history of a family of Paradise Ducks which were taught by their parents to catch crustacea in the sea is told by R. Henry.

Uses. The flesh of the Paradise Duck is considered to be good eating, especially when young, and formerly large numbers were killed in the Marlborough district for the Wellington market. Paradise Ducks are easily tamed and bred in captivity. They have been exported for ornamental purposes to various countries and have bred in England. If allowed to breed unmolested they are liable to overrun agricultural districts and consume a certain amount of grass and damage crops. For this reason they have been shot and poisoned.

Maori. In the North Island, Colenso records that the Maori women used to wear as ornaments around their necks the mottled feathers of the Paradise Duck. Advantage was taken by the Maoris of the inability of these birds to fly during the moulting season for killing large numbers for food. Thus Beattie describes a hunt that took place on Lake Waihola in 1859. The Maoris started out at daybreak in canoes and rounded up great numbers of young and moulting adult ducks, killing them with sticks. They returned with six or seven hundred birds, cleaned them and hung them up to dry, to be subsequently stored for future use. The bones of the Paradise Duck have been found in caves used by the moa hunters near the Heathcote Estuary.

Kapiti Island *Amy Wilkinson*

PARADISE DUCK FEMALE ON NEST

References.—Gmelin, Syst. Nat., 1, 505, 1789 (*Anas variegata*, Dusky Sound). Buller, Birds N.Z., 241, col. pl. 1872; 2nd ed., 2, 264, col. pl. 1888. Henry, Emu, 6, 171, 1907. Andersen, Trans. N.Z. Inst., 43, 657, 1911 (song). Oliver, Emu, 36, 69, col. pl. 1936. Wilkinson, Kapiti Bird Sanct., 87, 1952.

Chestnut-breasted Shelduck

Casarca tadornoides

The inclusion of this species in the avifauna of New Zealand rests upon a single specimen shot on Lake Ellesmere. It is preserved in the Canterbury Museum.

Adult male. Head and upper part of neck glossy dark green; a white ring round the middle of the neck; upper back, breast and lower neck chestnut; back, scapulars and abdomen dark brown finely freckled; tail and tail coverts greyish black; wing coverts white; primaries and their coverts black; inner secondaries chestnut, outer glossy green forming a speculum. *Adult female.* Similar to male but duller; frequently a white ring round the eye and a whitish face; abdomen brown.

Distribution. Lake Ellesmere. One occurrence.

Australia, south of the Tropic of Capricorn. Tasmania.

Habits. The Chestnut-breasted Shelduck frequents salt water lakes and inlets, also inland swamps, lagoons and open plains. It usually nests in hollows in tall trees, but may nest in crevices in rocks as on Rottnest Island. It lays ten to fifteen creamy white eggs. Its food is mainly grass but aquatic plants and animals are also eaten.

Reference.—Jardine and Selby, Ill. Orn., 2, 62, 1828 (*Anas tadornoides,* New South Wales).

GENUS ANAS

Bill longer than head and tarsus, higher than broad at base, of nearly equal breadth throughout, lamellae of upper mandible visible at base. First quill longest. Hind toe small, narrowly webbed.

The relatively long bill distinguishes this species from its immediate allies. About thirty-five species are distributed over the whole world.

Key to New Zealand Species

Upper surface dark brown, the feathers margined with fulvous white.
  Larger, bill 55, wing 275 mm. *A. superciliosa*
  Smaller, bill 38, wing 204 mm. *A. gibberifrons*
Upper surface dark sepia, the feathers margined with light chestnut or pale brown.
  Wings about 200 mm. .... *A. chlorotis*
  Wings very short, about 140 mm. .... *aucklandica*

Reference.—Linne, Syst. Nat., 10th ed., 122, 1758 (*Anas,* type *A. platyrhynchos* L.). Gray, Gen. Birds, 3, 627, 1844 (*Nesonetta,* type *N. aucklandica* Gray). Salvadori, Cat. Birds Br. Mus., 27, 287, 1895 (*Elasmonetta,* type *Anas chlorotis* Gray). Fleming, Occ. Pap. Roy. Ont. Mus., 1, 1, 1935 (*Xenonetta,* type *X. nesiotis* Gray).

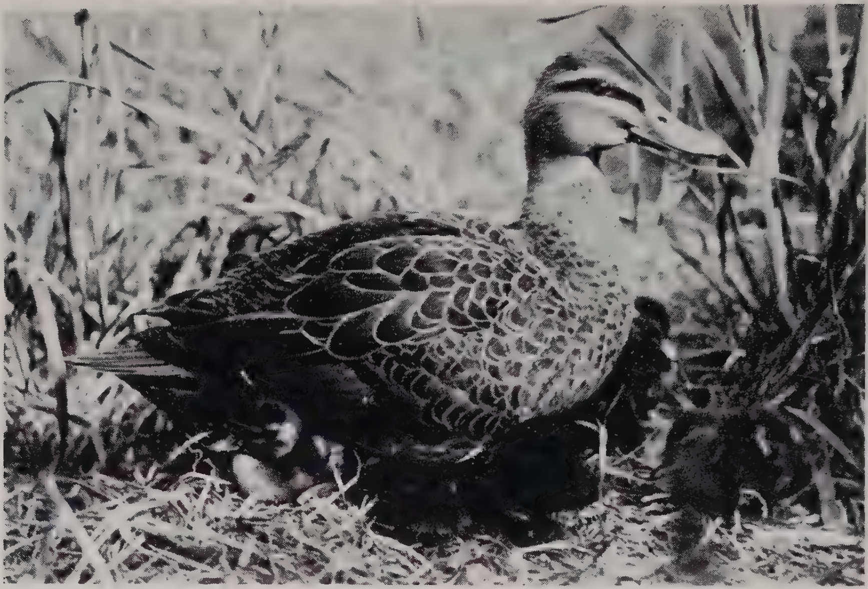
Grey Duck. Parera

Anas superciliosa superciliosa

The Grey Duck was one of the discoveries made by the naturalists of Cook's second voyage in 1773, it being met with both at Dusky Sound and Queen Charlotte Sound. G. Forster made a painting of it from which Latham described his Supercilious Duck, and, as with many others, Gmelin merely translated this to Latin and so founded the now accepted specific name. Yate in 1835 recorded that the Grey Duck was particularly tame and plentiful in the Thames River but that further north it was timid and wild. The Antarctic Expedition under Sir James Ross obtained it at Campbell Island in 1840 and in the following year the American Exploring Expedition found it in the Bay of Islands. It was obtained at the Chatham Islands about 1840.

Adult. Top of head and band from bill through eye brownish black; superciliary streak yellowish white; upper surface and sides of body blackish brown tinged with coppery on the mantle, each feather margined with fulvous white; wing coverts dark brown edged with black; primaries dark brown; speculum glossy green bordered on both sides with black; secondaries with terminal edge of white. Cheeks and throat yellowish white; mottled streak of dark brown from base of beak towards eye; sides of neck greyish brown mottled with yellowish white; foreneck, breast and under parts greyish brown varied with fulvous white; under surface of wings white. Bill greenish blue, nail black. Iris reddish brown. Feet yellowish brown. Bill 51-55, wing 260-275, tail 92-110, tarsus 40-46, mid toe 55-60 mm. *Nestling.* Upper surface olive-brown with hair-like filaments of pale brown; sides of head and lower surface pale yellowish brown; a dark band through eye and another below it. *Colour varieties.* Several partial albinos of the Grey Duck have been recorded, and pure white individuals have been described or seen. As, however, domestic ducks have on several instances escaped and lived with wild ducks the probability is that some of these individuals are hybrids. There is a grey variety with buff feather edgings from Pahiatua. *Hybrids.* The Grey Duck crosses freely with the mallard and the domestic duck both in captivity and wild. So far as has been tested the progeny are always fertile. Mr. Spens-Black informs me that in the vicinity of Rotorua there is quite a flock of hybrids between the Grey Duck and mallard with a distinct admixture of the American cayuga duck a domestic breed of *Anas rubripes.*

Eggs. Clutch six to ten, oval, creamy white,



Kapiti Island *Amy Wilkinson*

GREY DUCK

60.5 x 42, 59 x 41.5 mm. Raoul Island.

Status. According to Mathews, New Zealand specimens (*A. s. superciliosa*) are larger and darker than those from Australia (*A. s. rogersi*).

Other subspecies are *A. s. pelewensis,* Pelew Islands, and New Guinea eastward to Tahiti; *A. s. percua,* Sumatra, Java, Celebes and Lesser Sunda Islands.

Distribution. Kermadec Islands, North South and Stewart Islands, Great Barrier Island, Mayor Island, Kapiti, Chatham, Snares, Auckland, Campbell and Macquarie Islands. Abundant everywhere except on the southern islands where small numbers only have been seen.

Some interesting information regarding the movements of Grey Ducks within New Zealand has been brought to light by banding carried out by the Internal Affairs Department. The ducks were banded in the lower Manawatu district three miles south of Longburn and at Hokowhitu. Of 102 banded birds shot, 64 had travelled more than 20 miles, the greatest distance reached in the North Island being at Paeroa, 210 miles. Seventeen were shot in the South Island, some reaching Hokitika, 277 miles, and others Timaru, 335 miles from where the birds were banded.

Ecology. The Grey Duck is by far the most common of the ducks inhabiting New Zealand. Everywhere where there is water it is to be found, by mountain streams, lakes and lagoons, tidal estuaries and inlets, and it sometimes settles on the sea off the coast.

Increase of the settled areas has been accompanied by much clearance of native vegetation especially by the draining of swamps. A decrease of the food supply and feeding grounds results and, in consequence, there has been a steady decrease in the numbers of Grey Ducks. Doubtless this process will continue until all land suitable for occupation has been brought into use. A contributory factor to this decrease in Grey Ducks is that this species is the most favoured bird among sportsmen. No doubt the Grey Duck, with other species of ducks, helps in decreasing the numbers of water snails which harbour liver flukes during part of their life history.

Food. Both plant and animal matter form the food of the Grey Duck—insects, crustacea, molluscs, aquatic plants and their seeds. Its usual feeding places are the shallow places along the margins of lakes and swamps, where it upends for its food, and on intertidal mudflats in estuaries and inlets.

A valuable report by Mr. E. Turbott on the food of the Grey Duck showed that about 85 per cent. was of plant origin, the rest being insects and mollusca. The principal native plants eaten were muskgrass (*Nitella*), the sedges *Eleocharis, Cladium, Carex* and *Scirpus,* and fruits of *Coprosma* species. The change in the diet since Europeans arrived is shown by the important part now taken by introduced species, the principal ones, according to Turbott, being redshank (*Polygonum*), docks, bedstraw, water plantain (*Alisma*) and Canadian waterweed (*Anarcharis*). Balham gives the proportion of vegetable food in Grey and Mallard Ducks (combined) as 99 per cent.; 87 per cent. is duckweed.

Nesting. Very varied are the sites chosen by the Grey Duck for its nest. It is usually placed on the ground, though it may be built in trees up to a height of forty-five feet. It is always well hidden among thick fern, beneath a tussock, or merely in a hollow in the ground and is generally near water though sometimes at a considerable distance from it. The nest is made of dry grass. As incubation proceeds, the duck plucks down from her body until there is sufficient to cover the eggs. September to December are the usual months for laying and two broods may be reared in a season.

The following interesting notes on the incubation and hatching of the Grey Duck have been sent to me by Mr. M. E. Fitzgerald. All the eggs hatch practically simultaneously and one or two days earlier than 28 days after the last egg is laid. Eggs put cold under a hen or in an incubator take the full 28 days. From the 26th day onward the duck will not come off for a meal; when this occurs the eggs have commenced to chip; they will chip slowly all day and hatch during the night. While this is going on the duck stands in order to relieve the eggs from the weight of the body. The chick stays one day, or it may be longer, in the nest. The duck then leaves the nest and calls the ducklings to follow.

It has always been uncertain how the ducklings are removed from the nests in trees to the ground, but it would seem from recent observations that usually they fall down, especially if they are frightened. This has been actually seen by Stidolph. If the ducklings are too small to climb out of the nest then, as Wilkinson and others have observed, the parent bird will carry them one by one in its bill.

Another observer states that a mother duck took her stand at the foot of the tree and began calling the young which, one after another, leaped from the nest and, with the aid of their partly developed wings, landed gently alongside their mother. The last one, there were 11 in the nest, refused to leave despite the mother's calling. She evidently knew that 11 had to be accounted for. At last the duckling took courage and jumped. Yet another method, according to one eye-witness, is for the mother duck to carry its young from the nest on her back. The Grey Duck resorts to the practice of feigning a broken limb in order to lure its enemies away from the nest.

Maori. The method adopted by the Maori for taking ducks was described by Buller in 1878. The preserves where the ducks bred were carefully guarded and from October to February no canoes were permitted on the lakes and no fires allowed in the vicinity. In the moulting season, February and March, the birds are unable to fly through loss of quills, and at this time the close season was removed with much ceremony and the population prepared for a duck-hunting expedition. Men with dogs take cover in the scrub, women in canoes paddle out in the lake then jump in the water and drive the ducks ashore. They are caught by the dogs held by short leashes and killed by the Maoris biting their heads.

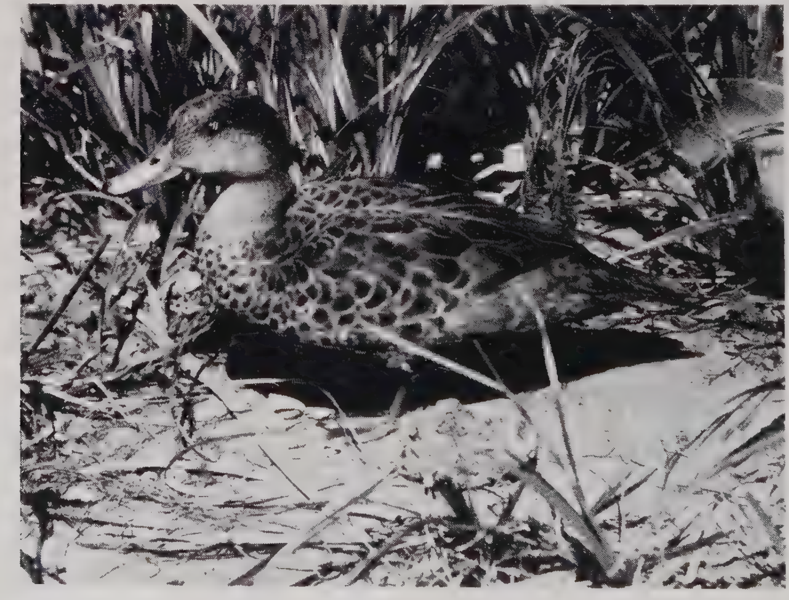
A more primitive method, without the use of dogs is thus described by Elsdon Best. A cord was stretched across a river, stream or lake arm, so as to be a little above the surface of the water, and to this cord were attached a great number of snares, the loops of which hung just above the water, so that the ducks when swimming under the line might thrust their heads through the loops and thus be caught.

References.—Gmelin, Syst. Nat. 1, 537, 1789 (*Anas superciliosa,* Dusky Sound). Buller, Birds N.Z., 245, 1872; 2nd ed., 2, 251, 1888; Supp., 2, 5, 1905. Guthrie-Smith, Birds, Water, Wood, Waste, 32, 1910. D'Ombrain, A.F. Emu, 44, 8, 1944. Turbott Ann. Rept. Auck. Acc. Soc., 1946. Balham, Emu, 52, 163, 1952. Wilkinson, Kapiti Bird Sanct., 91, 1952. Manson-Bahr, Bull. B.O.C. 73, 61, 1953 (Hybrids).

Grey Teal. Tete
Anas gibberifrons gracilis

The Grey Teal was first described from Celebes in 1842 and later was recognised in Australia. The first New Zealand specimens were taken by Sir Walter Buller on the Oroua River, near its junction with the Manawatu, in 1866, and were described by him as a new species (*Anas gracilis*). The species was next taken at Lake Kaitangata in May, 1877, and at Lake Wairarapa in June, 1879. Buller reported, in 1879, that the Grey Teal was plentiful at Lake Rotomahana. This was before the eruption of Tarawera Mountain (1886) which destroyed all life in the lake, though possibly most of the ducks would escape. The Grey Teal is now plentiful on the new and enlarged Lake Rotomahana.

Adult. Top of head blackish brown minutely marked with fulvous white; upper surface dusky brown with greenish reflections, the feathers of the back and scapulars margined with fulvous white; outer portion of upper wing coverts white forming a conspicuous bar; primaries and tail feathers dark brown; secondaries velvety black narrowly tipped with fulvous white, and a shining green speculum formed by the outer webs of the three middle ones. Sides of head fulvous white spotted with brown; throat and foreneck fulvous white; under surface light fulvous brown obscurely spotted with blackish brown. Bill pale brown, base



Kapiti Island *A. S. Wilkinson*

GREY TEAL

of lower mandible yellow. Iris dark brown. Feet pale brown, webs dark brown. Bill 35-38, wing 195-204, tail 85-100, tarsus 35-37, mid toe 44-50 mm. *Colour variety.* Wairarapa district. Head white; patch of brown on crown between eyes; chin and throat brown; patchy white collar on neck; upper parts of wing and edge of some primaries and secondaries white.

Eggs. Clutch nine-twelve (Australia), clutches known from New Zealand five to nine, rounded almost equally at both ends, buffy white, 51.8 x 37.2, 52 x 37.5 mm., Gladstone (Stidolph). Eggs from same locality, in another clutch, buff brown, 53.2 x 40.9, 54.6 x 40.6, 49.6 x 33.3, 48.9 x 32.9 mm., the last three described as quite pointed at narrower end. (Cunningham.)

Status. This species has been much confused with *A. castanea* of Australia, the male of which differs in the head being green and the breast chestnut. The females are, however, identical in appearance in the two species and similar to the males in *A. gibberifrons.* As the two forms so far as is known breed separately and all New Zealand examples are alike in plumage there is no reason to think that they all belong to one species with two male forms. *A. gibberifrons* is recognised by its general grey colour, small size and white alar bar.

Three subspecies have been defined of which the New Zealand and Australian one (*A. g. gracilis*) is larger and lighter coloured than the typical subspecies. The other subspecies are *A. g. gibberifrons,* Java to New Caledonia; and *A. g. albogularis,* Andaman Islands.

Distribution. Generally distributed from the Lower Waikato and the Bay of Plenty southwards to Foveaux Strait, but scarce everywhere except in the Rotomahana district and in the Wairarapa valley. It is known to breed in both these localities. In 1889 it was reported as being common at Lake Brunner. Localities recorded: Lower Waikato, Rangitaiki River, Lake Rotomahana breeding, Lake Okataina, Lake Rerewhakaitu, Waiotapu, Lake Taupo, Napier, Oroua River, Otaraia, Gladstone breeding, Lake Wairarapa, Lake Onoke, Kapiti, Marlborough, Aorere River, Lake Ellesmere, Lake Brunner, Lake Pukaki, Okarito, Poolburn, Lake Waihola, Kaitangata, Lake Hauroko, George Sound, Caswell Sound, Dusky Sound. Chatham Islands (one, 1951).

Australia. Tasmania.

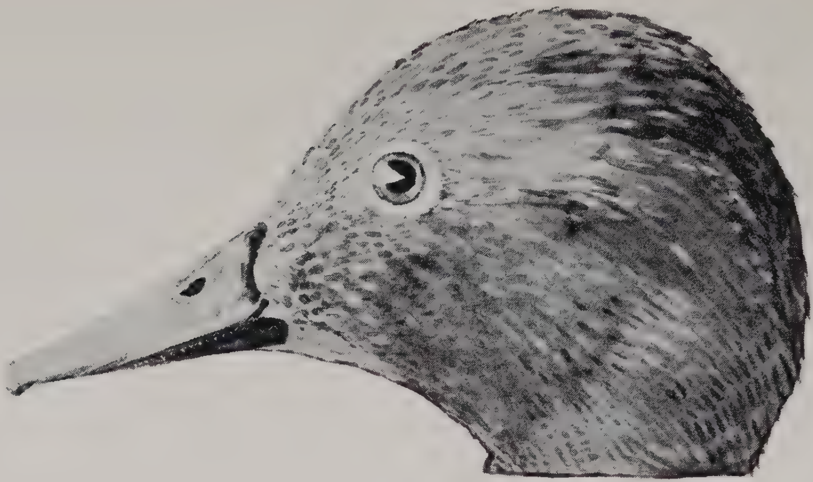
Habitat. Lakes, lagoons, swamps and creeks are the resort of the Grey Teal. A colony of between 50 and 100 birds near Gladstone "appears to be somewhat restricted in its distribution to two or three small lagoons and nearby swamp areas adjacent to a 70-acre bush reserve." (Stidolph.)

Nesting. The first nest of the Grey Teal to be found in New Zealand was discovered near Gladstone by R. H. D. Stidolph, from whose account the following is taken. "The nest was placed under a sparsely-leaved cutty grass tussock, eighteen inches above shallow water. The nest was screened by the leaves of the grass and partly by a fallen willow bough. It was built of dry cutty grass blades and the cup was lined with down, the nest being nine inches in diameter, of which the cup occupied six inches The eggs hatched on October 5.

"On making another visit to the locality on October 23, I saw three broods of Grey Teal ducklings—one of four, at least three weeks old, one of six, about a fortnight old, and one of seven, one or two days old."

A nest found at Lake Rotomahana is described by J. M. Cunningham as on a clay bank four feet above water, egg laid on bare soil and decaying leaves. Near Gladstone he found a nest of dry grass, no down, about 18 inches above shallow water, and another on top of a niggerhead (*Carex*). The breeding season evidently extends over a long period as Messrs. Bull and McKenzie saw at Lake Rotomohana on February 11, 1948. seven ducklings about one week old.

References.—Muller, Verk. Nat. Gesch. Land. Volk., 1842, p. 159 (*Anas gibberifrons,* Celebes). Buller, Ibis, 1869, p. 41 (*Anas gracilis,* Oroua); Birds N.Z., 250, 1872; 2nd ed., 2, 261, 1888. Stidolph, Emu, 44 288, 1945.



E. H. Atkinson

AUCKLAND ISLAND FLIGHTLESS DUCK

Auckland Island Flightless Duck
Anas aucklandica aucklandica

The Auckland Island Duck was discovered by the naturalists of the *Erebus* and *Terror* under the command of Sir James Ross, who called at Port Ross in 1840. Two specimens were obtained and the species was described and figured by Gray in the report on the birds of the voyage. Buller strangely enough omitted the species in the first edition of his work, but on receiving a specimen collected in 1880 by Mr. Burton of the Colonial Museum, admitted it in the second edition. It has been observed by all subsequent visitors to the group.

Adult male. Head and neck sepia, glossy above, patches of glossy green from behind eyes to hind neck; upper surface dark sepia with faint greenish gloss and with chestnut edges to feathers; lower hind neck, mantle, scapulars and sides of body waved with fine sepia and buff lines; primaries sepia, lighter on inner webs; secondaries glossed with green on outer webs and tipped with pale cinnamon, a faint greenish speculum is seen when viewed from behind. Chin mottled pale sepia and buff; breast bright russet, the feathers spotted subterminally with dark sepia; abdomen buff spotted and barred with sepia and with pale edges to the feathers; under tail coverts dark sepia edged with brown. Bill slaty grey. Iris dark brown. Feet brown. Bill 40, wing 125-135, tail 95, tarsus 35-37, mid toe 48-52 mm. *Adult female.* Slightly smaller than male. Generally similar to male but head and neck sepia without gloss except slightly purplish on crown; no vermiculations anywhere; outer webs of secondaries not more green than rest of body; chin more distinctly mottled than in male; breast umber, the feathers edged with paler and without subterminal spots; abdomen sepia, the feathers broadly edged with whitish; under tail coverts sepia with lighter edges. Bill 35, wing 125, tail 90, tarsus 32, mid toe 45 mm. *Nestling.* Covered with dark olivaceous brown down, fading to pale fulvous brown on throat and foreneck and dull fawn colour on breast and abdomen.

Eggs. Clutch three or four, elliptic, slightly smaller at one end, cream, 61 x 45, 65 x 46, 63.5 x 43, 64.5 x 45.6 mm.

Status. A. aucklandica and *A. chlorotis* differ slightly from the other species of *Anas* in possessing a narrow soft membrane on the apical portion of the upper mandible and they have weak specula. For these reasons and for the short wing in *A. aucklandica* they have each received a distinctive generic name, *Nesonetta* for *A. aucklandica* and *Elasmonetta* for *A. chlorotis*. If generic or subgeneric status is desirable they should both be placed under *Nesonetta*, the earlier name. *A. aucklandica* agrees with *A. chlorotis* in general coloration but differs in the very short wing, 140 against 200 mm., the less developed lamellae in the bill and the weaker speculum.

Distribution. Auckland Islands, plentiful. Now chiefly confined to Adams, Disappointment, Rose, Ocean, Ewing and Enderby Islands.

Transferred to Kapiti in 1907.

Habits. The Auckland Island Duck frequents the sheltered coasts, being especially abundant among the kelp which fringes the shore. The birds are of a similar colour to the kelp and consequently are not easily seen. They are quite fearless; as I walked along the shore a whole flock came running towards me and stopped a few feet away to feed on the kelp. Waite found them high up on the hillsides in the watercourses. Though usually spoken of as flightless, Captain Bollons stated that they were able to fly short distances and reached their nests in the cliffs by this means.

Nesting. According to Waite, who quotes Captain Bollons, the eggs are laid in holes in cliffs fifteen to twenty feet above the sea level. Bollons has on several occasions seen the ducks rise at the foot of the cliff and by the aid of the wings alone plump straight into the holes.

References.—Gray, Zool., Erebus and Terror, Birds, 16, col. pl. 1845 (*N. aucklandica*, Auckland Is.). Buller, Birds N.Z., 2nd ed., 2, 263, col. pl. 1888; Suppl., 2, 14, 1905. Falla and Stead, Trans. Roy. Soc. N.Z., 68, 37, 1938.

Campbell Island Flightless Duck

Anas aucklandica nesiotis

A single specimen of this small flightless duck was collected on Campbell Island in 1886 by Captain Fairchild of the Government steamer *Stella*. It was not seen again until 1943 when members of the coast watching party then stationed on the island observed it. Fairchild's specimen was described in 1935 by J. H. Fleming as a new genus and species, *Xenonetta nesiotis*.

Adult male. Smaller than *A. a. aucklandica*; upper surface sepia, with lighter edgings to upper tail coverts and feathers of back; under surface umber without spots or vermiculations, but with light buff edgings to the feathers of lower breast and abdomen; wings without speculum. Bill 35, wing 135, tail (much worn) 64, tarsus 30, mid toe 46 mm.

Status. In its small size, absence of vermiculations and in having an indistinct speculum *A. a. nesiotis* resembles the female of *A. a. aucklandica*.

Distribution. Campbell Island. Very scarce.

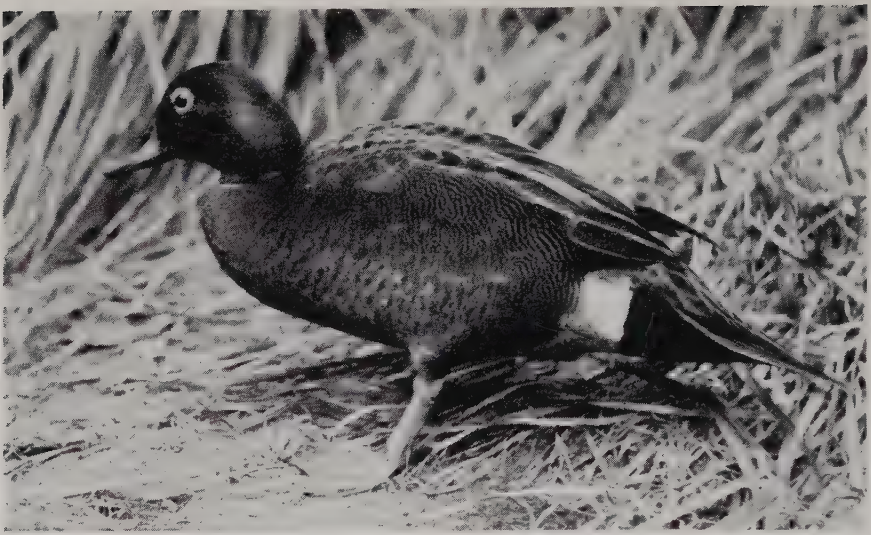
References.—Fleming, Occ. Papers Roy. Ont. Mus., 1, 1, 1935 (*Xenonetta nesiotis*, Campbell Island). Stead, Trans. Roy. Soc. N.Z., 68, 100, 1938.

Brown Duck. Pateke

Anas chlorotis

The Brown Duck was first collected in New Zealand about 1840 by P. Earl who forwarded a number of specimens to the British Museum. These were described by G. R. Gray in his report on the birds obtained by the Antarctic Expedition under Sir James Ross. Its nest was first described from Canterbury by Potts in 1870.

Adult male. Head and upper part of neck brown, the crown with a chestnut tinge, sides of head posteriorly and nape slightly glossed with green; upper surface brown, the feathers edged with pale brown; scapulars finely waved with black and rufous, the outer ones black on the outer webs; lateral upper tail coverts black glossed with green on outer webs; tail feathers brownish black with rufescent edges; wings brown; speculum black, metallic green on upper part, bounded above by narrow cinnamon band and below by rufescent white band. Throat whitish; a white collar on foreneck; lower foreneck chestnut passing to pale reddish on breast



C. A. Fleming

BROWN DUCK

and abdomen; black spots on lower foreneck, transverse on breast and abdomen; flanks waved with rufous and black lines; under tail coverts black, a white patch on each side; under wing coverts brown; axillaries white. Bill bluish black; lamellae yellowish brown. Iris black. Feet slate-grey. Bill 41-45, wing 196-210, tail 90-100, tarsus 38-42, mid toe 45-55 mm. *Adult female.* Similar to male but with rufous edgings to feathers of head, and upper wing coverts; vermiculations on scapulars absent; no white collar on foreneck; no greenish gloss on head; sides of head, and foreneck speckled with fulvous grey. *Immature.* Similar to the adult female. *Nestling.* Upper surface blackish brown with lighter markings; under surface yellowish brown. *Colour varieties.* Several partial albinos have been recorded, some with the entire head, besides other parts, white, and all with more or less white on the head. An albino obtained at Horowhenua Lake and described by Buller was cream colour with obsolete markings. A specimen from Mahia Peninsula is white; face and under surface variegated with buff; feathers of upper surface faintly brown.

Eggs. Clutch five-seven, elliptical, cream, 61 x 43, 62 x 42 mm. Turakina.

Distribution. Formerly abundant throughout the North, South and Stewart Islands. Chatham Islands prior to 1915. Kapiti Island about 1873. Now practically restricted to certain areas of Northland (Waipu, Kara, Bay of Islands, etc.), Great Barrier Island, Rotorua district, Mayor Island, Fiordland, Ruapuke, Stewart, and Codfish Islands.

Ecology. During the daytime the Brown Duck hides in the thick growth of raupo or sedges found along the edges of creeks or in the swampy kahikatea forest. At dusk, however, it comes out and is then quite fearless and may be seen feeding along the shores of intertidal creeks, and in mangrove swamps. Boggy creeks and slow-flowing streams are its favourite haunts. It feeds all night and hides all day.

With the spread of settlement, involving the draining of swamps and the tramping of cattle, it decreased rapidly and has now disappeared almost everywhere. In some localities it is still common, though it is distinctly unsafe in its northern stronghold. Guthrie-Smith recorded it as common on Tutira Lake, Hawke's Bay, in 1910 but about fifteen years afterwards he could find none. He blamed cattle which destroyed its cover and breeding places.

Reporting on the birds in the north of Auckland in 1936 C. A. Fleming says: The Brown Duck appears to be confined to its own watershed—once they have disappeared from a river system they fail to reappear though they may be present a few miles away. Within the watershed they appear to breed in the higher reaches, and move down with their families to tidal areas (if any) where flocks of non-breeding birds occur.

Nesting. The nest of the Brown Duck has seldom been found. Potts, writing of Canterbury, states that it is made of grass, lined with down, and placed close to the edge of swampy creeks or beneath the leaves of large niggger heads (*Carex*).

In the north of Auckland (1936) Fleming describes the nests as well made of grass with a varying amount of down. They were in a variety of situations—in long grass, dead manuka, roadside ditches. The Brown Duck lays in July and August and later. Young ducklings were seen in December. The brood of five to seven is usually reduced as the ducklings age and with the journey downstream, often to two birds.

References.—Gray, Zool. Erebus and Terror, Birds, 15, col. pl. 1845 (*Anas chlorotis*, New Zealand). Buller, Birds N.Z., 248, 1872; 2nd ed., 2, 257, col. pl. 1888; Suppl., 2, 11, 1905. Guthrie-Smith, Birds, Water, Wood, Waste, 36, 1910. Fleming, Ann. Rep. Orn. Soc. N.Z., No. 1, 1941.

GENUS SPATULA

Bill longer than head, narrowed at base, much dilated at apical end which is furnished with a small hooked nail; lamellae of upper mandible very prominent in the middle. Wings long, first and second quills longest. Tarsus much shorter than bill, hind toe narrowly webbed, elevated.

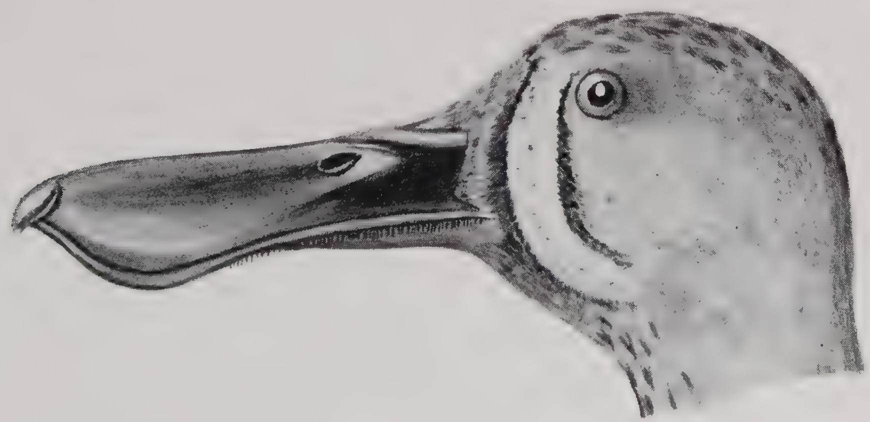
Spatula is easily distinguishable from all the other ducks by the spatulate bill, in this respect resembling Malacorhynchus of Australia. From this genus, however, it is distinguished by having no soft membrane at the sides of the bill towards the tip. Four species divide the world among them.

Reference.—Boie, Isis, 1922, p. 564 (*Spatula*, type *Anas clypeata* L.).

Shoveller. Tete. Kuruwhengi

Spatula rhynchotis variegata

The Shoveller was first discovered in Australia whence specimens were described by Latham in 1801. In New Zealand it was first obtained by P. Earl at Waikouaiti in the South Island and by Dieffenbach at the Chatham Islands about 1840. In 1856 some specimens forwarded to England by W. B.



C. McCann

SHOVELLER

D. Mantell were described by Gould as a new species, but the New Zealand form is now admitted to be only subspecifically distinct from the Australian one. Potts seems to be the first to describe the breeding habits and life history of the New Zealand Shoveller.

Adult Male. Face, top of head and nape brownish black, the feathers edged with grey; sides of head and sides and back of neck bluish grey with greenish reflections; back blackish brown, the feathers edged with pale brown and glossed with green; rump and upper tail coverts glossed with green; tail black; short scapulars brown with white crescents and rufous edges; long scapulars glossy black with central greyish white stripe, outer ones with outer webs light blue; upper wing coverts light blue, the anterior ones of last row broadly tipped with white; quills dark brown, a glossy green speculum formed on the outer webs of the outer secondaries. A white crescentic band on each side of head; throat brown mottled with white; feathers of lower foreneck and breast whitish with brownish black crescentic bands and edged with rufous; lower breast and abdomen chestnut with black spots and bars; under tail coverts black glossed with green; a white patch freckled with brown on each flank; under wing coverts and axillaries white. Bill blue-black. Iris yellow. Feet orange-yellow. Bill 55-62, wing 230-250, tail 86-102, tarsus 33-39, mid toe 45-55 mm. *Adult Female.* Upper surface blackish brown, each feather margined with fulvous. Under surface ochre-brown spotted and blotched with blackish brown (the centre of the feathers being this colour as on the upper surface). Wings as in male. Scapulars brown glossed with green and edged with fulvous. Bill greenish grey. Iris reddish brown. Feet dull yellowish ochre. Smaller than male. *Immature.* Resembles the adult female but darker. *Nestling.* Upper surface olive-brown with fulvous yellow marks on head, back and rump; under surface fulvous yellow. *Colour Varieties.* Some partial albinos have been obtained at Lake Ellesmere.

Tirau *C. A. Fleming*

SHOVELLER

A specimen, more nearly an albino, also from Lake Ellesmere, is in the Canterbury Museum. The upper surface is light brown, the feathers edged with white; head striped brown and buff; under surface variegated reddish brown and pale brown. Compared with the bird in normal plumage the blue, green and black have been replaced by white.

Eggs. Clutch ten to thirteen, creamy white, 52.2 x 38, 52.8 x 39.4 mm. Lake Ellesmere.

Status. Two subspecies have been described, one from Australia and one (*S. r. variegata*) from New Zealand characterised by a greater amount of white on the lower neck and breast.

Distribution. North and South Islands; in numerous localities throughout but not now in large numbers. Kapiti Island. Chatham Islands (last record 1925). Straggling to Auckland Islands.

Habits. The Shoveller Duck is fairly plentiful in certain localities, being found in pairs or small flocks on lagoons near the sea, as well as inland lakes and rivers, and creeks in the forest. Its food, according to Buller, consists of molluscs, insects, seeds and herbage. Its sifting apparatus is well developed consisting of prominent lamellae on the bill and bristle on the tongue. The only description of the nest that has been published is that of Potts who states that a nest was found on the ground beneath the shelter of tussocks of grass and wild spaniard (*Aciphylla*) at some distance from water. It was made of grass lined with down.

References.—Latham, Ind. Orn. Suppl., 70, 1801 (*Anas rhynchotis*, N.S.W.). Gould, Proc. Zool. Soc., 1856, p. 95 (*Spatula variegata*, New Zealand). Potts, Trans. N.Z. Inst., 3, 102, 1871. Buller, Birds N.Z., 252, col. pl. 1872; 2nd ed., 2, 269, col. pl. 1888.

GENUS AYTHYA

Bill broad and short, about as long as head, and as wide at tip as at base; lamellae of upper mandible not prominent. First and second quills longest. Tarsus shorter than bill; hind toe broadly lobed.

Aythya comprises 12 species all widely distributed over the Holarctic Region except *A. novaeseelandiae* which is confined to New Zealand, and apparently comes nearest to *A. fuligula* which extends into the Malayan region.

Key to Species

General colour black with greenish gloss .... *A. novaeseelandiae*
General colour dark brown .... *A. australis*

References.—Boie, Isis, May 1822, Heft V, col. 564 (*Aythya*, type *Anas ferina* L.). Fleming, Phil. Zool. 2, 260, June 1822 (*Nyroca*, type *Anas rufa* L.). Stephens, Shaw's Gen. Zool., 12, 187, 1824 (*Fuligula*, type *Anas fuligula* L.).

New Zealand Scaup. Papango

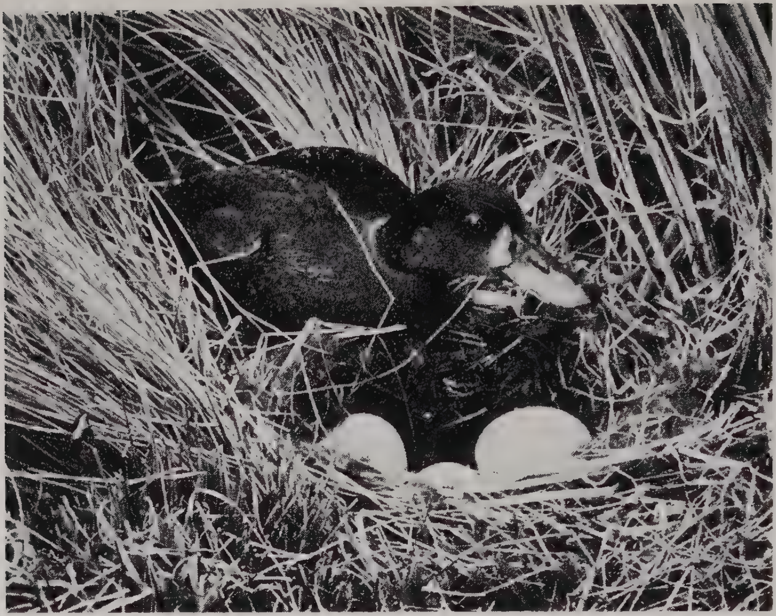
Aythya novaeseelandiae

The New Zealand Scaup, or Black Teal as it is generally called, was discovered at Dusky Sound during Cook's second voyage. Forster, who accompanied Cook, recorded that it was gregarious and found at the mouths of rivers in bays little exposed to the wind. He left a drawing from which Latham described his "New Zealand Duck," a title adopted by Gmelin when founding the specific name. The next incident in the history of this scaup is its collection by the Antarctic Expedition under Sir James Ross at the Bay of Islands in 1841. Potts was the first to give an account of its breeding habits.

Adult Male. Head and neck black with purplish reflections when seen from in front, green when seen from behind; remainder of upper surface black glossed with green; scapulars and upper wing coverts minutely dotted with white; primaries dark brown, paler on inner webs; secondaries brown glossed with green, the outer ones with a white patch on outer webs forming a white speculum; tail dark brown. Point of chin white; foreneck and breast blackish brown; abdomen closely vermiculated fulvous white

Queenstown *Isabella Tily*

NEW ZEALAND SCAUP



Lake Alexandrina *K. V. Bigwood*

NEW ZEALAND SCAUP FEMALE

and brown; sides and under tail coverts dark brown. Bill bluish black. Iris yellow. Feet dark brown, webs black. Bill 37-41, wing 180-200, tail 58-70, tarsus 30-34, mid toe 56-62 mm. *Adult Female.* Brown with a dull white speculum; chest and sides chestnut brown; abdomen whitish variegated with brown. White band on forehead from April or May to December. *Nestling.* Upper surface pale brown with dusky collar and obscure whitish spots on wings and rump; under surface white. Bill reddish brown, lower mandible yellow. Iris dark brown. Feet light brown.

Eggs. Clutch five to eight, elliptic, 66 x 44, 65 x 43.6, 64.2 x 45 mm. Lake Heron.

Distribution. North and South Islands; abundant in many places but disappearing in the settled districts. Now absent from large areas.

Habits. The Scaup is found in inland lakes and on lagoons near the sea. It prefers clean waters. It is to be seen in flocks resting on the water at some distance off the shore or closer in near the reed swamps. Its food is mainly obtained by diving so that if the water be shallow enough it may be seen feeding at a considerable distance from the shore. According to Fitzgerald chicks a day old can go down six to eight feet.

These friendly birds frequent the wharves at Queenstown, Lake Wakatipu, where Mrs. Isabella Tily made the following interesting notes on their diving habits: They dived to the bottom of the lake where the water appeared to be five or six feet deep. Sometimes they swam along under water without touching bottom. At other times they would go right to the floor of the lake where they fed on something the nature of which I could not ascertain. They were able to stay under water from 20 to 22 seconds. When near the bottom their legs seemed to work on pivots. Not only were they used sideways, but actually were raised so high that the feet appeared to be higher than the back of the bird.

Nesting. According to Guthrie-Smith the "nest is buried among flax roots and fallen blades half supporting layers and layers of rubbish of ten, fifteen and twenty years' accumulation. The bolt holes are narrow and perpendicular and the runs tortuous. The Scaup breeds at the very edge of the lake." The nest is built of grass and lined with down, and the eggs laid between October and March. The young when alarmed dive and swim out towards the centre of the lake while the parents distract the attention of the enemy, be it dog or man, near shore.

To the above information Mr. M. E. Fitzgerald adds: The clutch is five or six laid on alternate days. Incubation takes 30 days. Nests are in colonies and are very close to the water. The older birds commence to lay in October and if a nest or a young clutch is lost a second effort may be made. The yearlings seem to wait until December to lay. Herein lies a probable explanation for the fact that at one colony all chicks appear in November, at another in January, while elsewhere hatching takes place at both times. Probably the older birds are first to feel the urge to move off to a place where there will be ample food for the chicks. Later, the yearlings experience the same anxiety—sometimes there are so few remaining that they decide to stay on—sometimes they move off to join their elders where they may find room. Then again they may not, so they move off again to pastures new.

References.—Gmelin, Syst. Nat., 541, 1789 (*Anas novaeseelandiae,* Dusky Sound). Gray, Zool., Erebus and Terror, Birds, 16, col. pl. 1845. Potts, Trans. N.Z. Inst., 2, 73, 1870. Buller, Birds N.Z., 259, col. pl. 1872; 2nd ed., 2, 273, col. pl. 1888. Guthrie-Smith, Birds, Water, Wood, Waste, 17, 1910.

White-eyed Duck. Karakahia

Aythya australis

The White-eyed Duck was first noticed by Hutton in 1867 on Whangape Lake, in the Lower Waikato, and in 1868 it was found to be abundant on Lake Waikare in the same district. The first specimen collected was shot by A. M. Sheppard. Subsequently it was taken in several other parts of New Zealand, the last recorded instance being Tutira, Hawke's Bay, in 1895.

Adult. Head, neck and breast chestnut brown; back and scapulars dark brown, each feather edged with olive-brown; rump dark brown; tail brown; wings brown glossed with olive; primaries in middle portion, and secondaries mostly white, forming a conspicuous bar. Abdomen white, the lower part brown; sides brown, feathers edged with paler; under wing and tail coverts white. Bill black, bluish at tip with black nail. Iris white in male, black in female. Feet grey, webs black. Bill 50, wing 220, tail 65, tarsus 38, mid toe 61 mm. The female is smaller and duller than the male, the head and neck being brown.

Eggs. Clutch seven to thirteen, elliptic, creamy white, 57.6 x 42.4, 57.4 x 41.7 mm. Australia.

Distribution. Lakes Whangape, Waikare, Tarawera, Tutira, Te Aute, Wairarapa and Ellesmere, and the Manawatu and Otago districts. Once reported abundant in the lower Waikato and on Lake Rotomahana before the eruption of Mount Tarawera in 1886. No records after 1895 except a sight record at Hamurana in 1934.

Habits. In the Lower Waikato, Hutton stated that it frequented the lakes and was rarely seen on the rivers and creeks. In Australia its food consists of shellfish, aquatic plants, fish and crustacea. It associates with the coot catching the shrimps which the coot disturbs. The coot catches the shrimp under water but the duck catches about twice as many as they jump out. In Western Australia the nest is placed in a bushy tea-tree growing among bullrushes and is composed of bullrushes lined with down.

References.—Eyton, Monogr. Anat., 160, 1838 (*Nyroca australis,* N.S.W.). Hutton, Trans. N.Z. Inst., 2, 78, 1870. Buller, Birds N.Z., 257, 1872; 2nd ed., 2, 275 1888.

GENUS HYMENOLAIMUS

Bill as long as head, compressed at base, sides sloping from culmen to margins; apical half of margin of upper mandible composed of a soft flexible skin that hangs over lower mandible; lamenae visible along basal half. First and second quills longest; short blunt spur at carpel flexure. Tail long. Tarsus equal to bill; hind toe strongly lobed.

Hymenolaimus includes a single species confined to New Zealand.

Reference.—Gray, Ann. Mag. Nat. Hist., 9, 370, 1843 (*Hymenolaimus,* type *Anas malacorhynchus* Gmel.).

Blue Duck. Whio

Hymenolaimus malacorhynchus

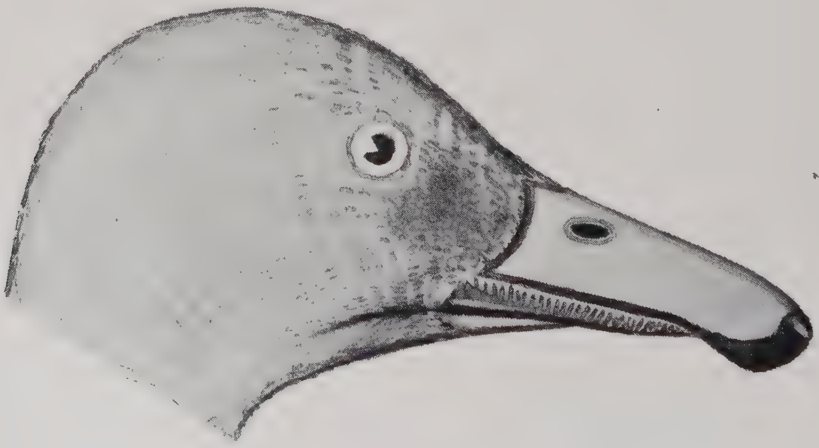
Captain Cook in the account of his second voyage to New Zealand refers to the "Blue-Grey Duck or the Whistling Duck, as some called them from the noise they made." This was at Dusky Bay in May, 1773. Forster, who accompanied him, stated that it was found in fresh-water streams in the forest and always in pairs. Latham's "Soft-billed Duck" was described from Forster's drawing, and Gmelin, as was his custom, translated Latham's description and name to Latin, thus founding the specific name. About 1840 P. Earl collected a specimen at Waikouaiti on the east coast of Otago as it was swimming with his domesticated ducks, while Potts was the first to discover its breeding place, some time prior to 1870, in the gorge of the Potts River, a tributary of the Rangitata.

Adult. Head, neck and upper surface slate blue; top of head, scapulars and wing coverts olivaceous with a greenish gloss; upper back greenish blue; outer margin of secondaries black. Breast pale slaty blue blotched with chestnut; abdomen and under tail coverts pale slaty blue, the latter with some spots of chestnut. Bill pinky white, the tip and lateral membrane black. Iris yellow. Feet dark brown. Bill 44-47, wing 220-240, tail 95-116, tarsus 45-52, mid toe 60-70 mm. In the female the greenish gloss on the upper surface is less and there is less chestnut on the breast. *Immature.* Similar to adult female but lighter. *Nestling.* Top of head, hind neck, line through eye and upper surface olive-green; remainder yellowish white. Bill horn colour, membrane black. Feet yellowish.

Eggs. Clutch four to nine, elliptical, creamy white, 66.8 x 44, 65 x 46.5 mm. Canterbury.

Distribution. North and South Islands from the Pirongia Mountains, Coromandel Peninsula and Bay of Plenty southwards.

Habits. The home of the Blue Duck is the forest stream from far up among the mountains to sea level. This species seems to delight in the turbulent waters of mountain creeks, but it is also to be seen on the placid waters of the rivers entering the sounds of



E. H. Atkinson

BLUE DUCK

Otago, or on the brackish or salt water of the headwaters of the sounds. At Caswell Sound this duck could always be seen on the Stillwater River, especially at the outlet of Lake Marchant or between the lake and the sound where the river is more turbulent. They are often seen sitting on rocks or snags preening themselves.

Food. The Blue Duck obtains its food mostly by diving to the creek bottom and catching aquatic larvae. Buller found many caddis fly larvae in the stomachs. I once watched a Blue Duck from a distance of a few yards swimming about in a calm reach on the upper Hollyford River catching insects on the surface of the water.

Voice. Both the European name of Whistling Duck and the Maori name Whio are derived from the call of this bird. Its note according to Andersen is a high-pitched cry, not a whistle.

Nesting. The nesting site of the Blue Duck is generally a well-concealed hole in a bank or log or in the base of a clump of rushes near a stream. A typical site is thus described by Guthrie-Smith: "A nest was situated close to the Waikakau Stream, and hidden under an immense rush bush on the very edge of a sandy cliff. On the upper side of this ancient rush bush passed an almost imperceptible trail, which doubtless the duck would follow when entering the nest. On the river side and just overhanging the cliff was the flight hole from the felted growths of rush. The duck would reach her eggs by the trail and leave them on the wing, dropping quietly into the pool below." The nest is made of grass and lined with down and the eggs laid from August to November. When surprised with their young, the whole family usually resorts to safety by merely dropping down stream. The Blue Duck is unfortunately for itself not afraid of man and consequently offers an easy prey to both him and his dogs.

E. F. Stead

BLUE DUCK

Maori. The Blue Duck was generally taken at night with the aid of torches. Besides being used for food the breast feathers were worn by the women as ornaments suspended from the neck.

References.—Gmelin, Syst. Nat., 526, 1789 (*Anas malacorhynchus*, Dusky Sound). Buller, Birds N.Z., 262, col. pl. 1872; 2nd ed., 2, 276, col. pl. 1888; Suppl., 2, 17, 1905. Guthrie-Smith, Birds Water, Wood, Waste, 23, 1910. Buddle, Bird Secrets, 38, 1951.

Genus Mergus

Bill long, narrow, compressed, the upper mandible decurved at tip, both mandibles serrated, the serrations inclined backwards. Head crested. Tarsi shorter than bill; hind toe broadly lobed.

Distinguished by the slender sharply-serrated bill. There are four species in the northern hemisphere, one in Brazil and one in the Auckland Islands.

References.—Linne Syst. Nat., 10th ed., 129, 1758 (*Mergus*, type *M. merganser* L.). Mathews and Iredale, Ibis, 1913, p. 310 (*Promergus*, type *Mergus australis* Hombr. and Jacq.).

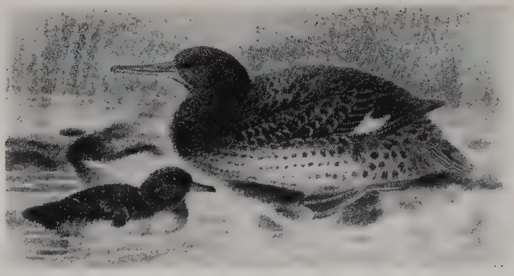
Auckland Island Merganser

Mergus australis

This very distinct species of Merganser was discovered at the Auckland Islands by Hombron and Jacquinot, the naturalists attached to the French expedition which in 1839 visited the group in the ships *Astro-*

labe and *Zelee.* The species has never been plentiful and only a few specimens have been procured. After the visit of the French expedition it does not appear to have been collected until 1874 when two were obtained by Baron von Hugel from one of the crew of a visiting vessel. Reischek obtained two in 1888 and fewer than twenty specimens have been collected since. The species has not been seen for about forty years. During my visit to the Auckland Islands in 1927 a search was made in an inlet where it was known to occur but none was seen.

Adult Male. Head and neck brown with a rufous tinge on the throat, foreneck and upper part of breast; a crest of brown feathers 5-6 cm. long on back of head; back, wings and tail blackish brown, a patch of white on the secondaries and greater wing coverts. Lower breast and abdomen greyish brown with longitudinal white bands; sides greyish brown the feathers edged with white. Axillaries white. Bill yellowish orange, blackish on culmen and at tip. Iris dark brown. Feet orange, webs, joints and soles dusky. Bill 60, wing 200, tail 90, tarsus 40, mid toe 70 mm. *Adult Female.* Similar to a male but smaller; rufous tinge on head and throat duller; crest shorter and darker, middle of abdomen less white. Bill 54, wing 180, tail 74 mm. *Immature.* Similar to female but no crest and feathers on upper surface edged with grey. *Nestling.* Upper surface dark olive-brown; yellowish white on edges of wing; throat and foreneck rufous; under surface yellowish white. Bill dark olive, brown on the ridge and tip. Feet olive brown.



From Buller, Suppl. Birds New Zealand
AUCKLAND ISLAND MERGANSER

Status. The Auckland Island Merganser differs from the other members of the genus in the sexes being alike in colour, and in the bill being rather more slender. Its closest ally is *M. brasiliensis.*

Distribution. Auckland Islands. Extinct since about 1910. Campbell Island (M'Cormick, 1840).

Semifossil in sand dunes at Lake Grassmere (R. J. Scarlett).

Habits. The habitat of this Merganser is the sheltered waters of the inlets, and the creeks in the valleys. Reischek states that when pursued it conceals itself among the rocks and does not dive like its European allies.

References.—Hombron and Jacquinot, Ann. Sci. Nat. (2), 16, 320, 1841 (*Mergus australis,* Auckland Is.); Voy. Pole, Sud. Zool., 3, 152, col. pl., 1855. Buller, Birds N.Z., 2nd ed., 2, 279, 1888; Suppl., 2, 21, col. pl. 1905. Ogilvie-Grant, Ibis, 1905, p. 565.

ORDER FALCONIFORMES

HAWKS

Bill short, culmen strongly curved, tip vertical; cere exposed. Feet bare, armed with powerful talons capable of being bent under the feet.

FAMILY FALCONIDAE. HAWKS

Head covered with feathers, there always being true feathers on the crown. Outer toes not reversible.

Key to New Zealand Genera

Upper mandible toothed	*Falco*
Upper mandible not toothed	*Circus*

GENUS FALCO

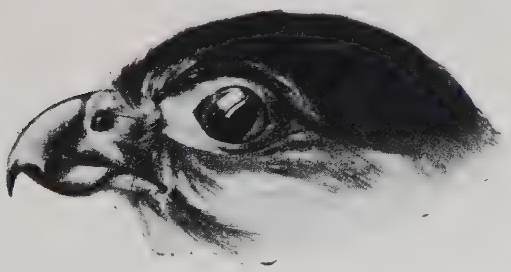
Bill with a distinct tooth near tip of upper mandible; lower mandible sinuated at tip; nostrils round, with central tubercle. Second and third quills longest. Middle toe much longer than inner and outer ones.

About 35 species distributed over the whole world except Polynesia. The New Zealand species differs from the others in its relatively longer tail. An Australian species (*F. cenchroides*) is an occasional visitor to New Zealand.

Key to New Zealand Species

Upper surface blackish brown	*F. novaeseelandiae*
Upper surface pale rufous	*F. cenchroides*

References.—Linne, Syst. Nat., 10th ed., 88, 1758 (*Falco*, type *F. subbuteo* L.). Obelholser, Proc. Acad. Nat. Sci. Phil., 1899, p. 203 (*Nesierax*, type *F. novaeseelandiae* Gmel.).



Lily A. Daff

BUSH HAWK

New Zealand Falcon. Bush Hawk. Karearea

Falco novaeseelandiae

The Bush Hawk was discovered in 1773 at Dusky Sound and Queen Charlotte Sound during Cook's second voyage. Latham called it the New Zealand Falcon which name was adopted by Gmelin when founding its present specific title. In 1775 two specimens were taken to England by Captain Clark. It was next collected by Lesson at the Bay of Islands in 1824. Yate, writing of it ten years later, refers to its tiger-like propensities and states that few birds that it pursues can escape its talons. It was discovered at the Auckland Islands in 1839 by Hombron and Jacquinot, naturalists to the French expedition and the following year was collected in the same locality by the British expedition in the *Erebus* and *Terror*. The United States Exploring Expedition collected specimens at the Bay of Islands in 1840 and shortly afterwards it was taken in Otago by Earl and at Stewart Island by Captain Stokes.

Adult Male. Upper surface blackish brown, darkest on the crown; back, scapulars, upper tail coverts and wing coverts barred with pale rufous; outer webs of quills and tail faintly barred with greyish white, inner webs broadly barred with white. Superciliary streak and sides of face and neck streaked with rufous and black; throat fulvous white with narrow black shaft lines; rest of under surface buffy white streaked with dark brown; thighs and under tail coverts rufous brown streaked with dark brown. Bill bluish black, shading to bluish-white below nostril and base of mandible. Cere pale yellow. Iris yellow. Feet yellow, claws black. Bill 17-18.5, wing 230-260, tail 164-195, tarsus 55-58, mid toe 57-60 mm. *Adult Female.* Larger. Bill 20-23, wing 265-305, tail 195-229, tarsus 60-62, mid toe 62-76 mm. *Immature.* Upper surface brownish black, superciliary streak fulvous; throat fulvous white with central line of brown on each feather; under surface dark brown varied with fulvous; sides with rounded spots of fulvous white; thighs reddish brown; lower abdomen and inner side of thighs fulvous. Cere bluish white. Feet dark grey. Buller kept a young Hawk for about a year. It was fully fledged when about six weeks old, and moulted partially in September when the spotted plumage began to appear. The mature plumage was completed by the following March. *Nestling.* White when hatched, later covered with bluish grey down; bill black; feet grey.

Colour Varieties. Potts describes birds (1) yellowish white dotted with brown, Paringa River, (2) yellowish white marked with reddish brown, Ashburton Gorge, (3) rich red brown with slight marks of blackish brown, Upper Waimakariri.

Eggs. Clutch two or three, slightly ovoid, rich brown with close blotches of dark reddish brown all over but mostly at larger end. 51.8 x 37, 48.4 x 37, 48.2 x 37.4 mm. Fairlie, South Island. 45.6 x 34.2, 45 x 34.2, 47.4 x 34.8 mm. Kereru, North Island.

Status. There are apparently two forms differing only in size. There are no specimens in museums or published records of paired birds sufficient to give definitions of these forms even in terms of size. The few instances of paired birds available indicate that the large males pair with the large females and the small males with the small females.

Distribution. North and South Islands.

Lake Ohau *K. V. Bigwood*

BUSH HAWK

Hen and Chickens, Little and Great Barrier Islands, Kapiti. D'Urville Island, Stewart Island, Codfish Island, Auckland Islands. Generally distributed but not common. Straggler to Campbell Island. Bones from the Chatham Islands are recorded by R. J. Scarlett.

Ecology. At present the Bush Hawk is most often seen in the forested areas frequently at high elevations, though it is found at sea-level on the offlying islands. No doubt it was formerly found in all situations but its fearlessness has been its undoing in the open and settled districts, as it pursues its prey regardless of all else, even man, sometimes entering houses, and as it includes the domesticated fowl and duck in its menu its bold predatory excursions generally result in its being shot. It is now seldom seen and north of Auckland has not been reported for more than twenty years. Guthrie-Smith in 1922 said there were five or six pairs in 20,000 acres of Hawke's Bay.

Although this fierce and fearless predator attacks all kinds of birds it does not always get its own way. It is reported as fleeing before mobs of tuis and Australian magpies. It attacks harriers which come too near its breeding area. The harrier makes all haste to get away and when the Falcon is within striking distance turns over on its back and strikes with its own terrible talons. Human beings are attacked when they come too near the nest, the Falcon swooping down to near the intruder's head and then with a scream sheering off. Nothing is more frightening and better calculated to scare anyone away than this method of attack.

Formerly the Bush Hawk created great havoc in farmyards among the ducks, fowls, pigeons and turkeys. Buller records one attacking a hen in a stockyard and not relinquishing its hold until killed with a stick. Once he saw a Bush Hawk attack kittens. It lifted one of the kittens some feet into the air but was unable to hold on. In eating rats and mice Bush Hawks do a small amount of good. Once a Bush Hawk was seen to carry and drop a stoat.

Lake Ohau *K. V. Bigwood*

BUSH HAWK NESTLINGS

Food. The food of the Bush Hawk is for the most part birds, all species being attacked. The pipit seems to suffer most in the open, but birds as large as ducks and pukeko are taken, while in the forest all the commoner species including tuis, pigeons, kakas and parakeets are its prey. Gulls, herons, shags and the stitch bird have been recorded among its victims. Introduced species such as chaffinches, yellow hammers, rock pigeons, starlings and blackbirds are taken. Finally, the Falcon catches rats, mice and lizards and it robs birds' nests. It flies low over the surface of the ground or forest, pouncing with lightning-like suddenness on any hapless bird that fails to see it soon enough, and relentlessly pursues those that seek safety in flight. On nearing its quarry it strikes suddenly with its talons which turn inwards and thus seize the smaller birds or perhaps pierce the head of the larger ones. Henry, writing of the birds at Dusky Sound, says that the hawks' most successful plan of hunting is to fly swiftly through the trees, when they have a great advantage over any other bird that fails to see or hear them in time to get a start. It is said to work pigeons out of the bush by flying underneath them

Voice. The cry of the Bush Hawk is a loud scream uttered on the wing and heard especially before bad weather.

Nesting. The site chosen by the Bush Hawk for its nest is generally in some place difficult of access. Most commonly it is placed on a ledge of a cliff with a fairly extensive view, but it is also built in the clusters of Astelia which grow on the upper branches of trees, in dense clusters of vegetation in the forest, on a shrub on a cliff, or in the fork of a tree. Little attempt is made to gather material for the nest on the ground, the eggs being laid in a depression lined with a small quantity of leaves and feathers. A better nest is made when the Bush Hawk builds off the ground. The nests are placed at considerable distances apart as the Bush Hawk tolerates no intruder in its domain. It fiercely assails any bird, dog or man that approaches its nest. Eggs are to be found in the months of September to December. Fully fledged young have been noted in early January.

An interesting account of nestling Bush Hawks is given by Guthrie-Smith who watched a nest in the Tutira district, Hawke's Bay. Two is the usual number of young birds reared. Of the two chicks, one is considerably the larger and probably is the female. Guthrie-Smith thinks that the young are well brought up. There is no quarrelling, he says, except, sometimes, at meal times, no snatching of food is tolerated. When the chicks are tiny the prey is torn up and fed to them. Later it is dangled in the beak and the young are encouraged to grow fierce and rush up and seize it. For several weeks after being fully fledged the young are tended and probably partly fed by the old birds. When molested the young throw themselves on their backs and strike fiercely with their talons. Both parents fetch food for the young and sometimes food brought by the male is taken by the female and fed to the chicks.

References.—Gmelin, Syst. Nat., 1, 268, 1788 (*Falco novaeseelandiae,* Queen Charlotte Sound). Potts, T.N.Z.I. 6, 139, 142, 1874. Buller, Birds N.Z., pp. 1, 6, col. pl. 1872; 2nd ed., 1, pp. 213, 220, col. pl. 1888. Mathews and Iredale, Ibis, 1913, p. 420. Moncrieff, Emu, 26, 273, 1927. Guthrie-Smith, Birds, Water, Wood, Waste, 107, 1910. Buddle, Bird Secrets, 33, 1951. Wilkinson, Kapiti Bird Sanct. 41, 1952.

Nankeen Kestrel

Falco cenchroides

The Nankeen Kestrel has been recorded several times in New Zealand. The first specimen was shot by Mr. E. C. Studholme at Waimate, Canterbury, about 1889, and the second by Mr. J. R. Dickson, light-keeper at Portland Island, in 1895.

Adult Male. Upper surface pale rufous with black streaks on head, neck and scapulars; rump, upper tail coverts and tail blue-grey, the tail with subterminal black bar and white tip; primaries blackish brown notched with white on inner webs. Forehead and sides of face greyish white; under surface tawny buff streaked with black on breast and sides. Bill horn colour, black at tip. Cere and orbits yellow. Iris brown. Feet orange. Bill 18, wing 235, tail 156, tarsus 38, mid toe 34 mm. *Adult Female.* Similar to male but larger; tail pale rufous tipped with white, and with narrow black bars except the subterminal one which is broad. *Immature.* Similar to adult female but upper surface spotted with black.

Eggs. Clutch four or five, ovoid, pinkish white, freckled and blotched with reddish brown and dark brown, 41 x 35, 41 x 34.5 mm. Australia.

Distribution. Eight occurrences. Oruawharo (Kaipara), Portland Island, Castlepoint, Wellington, Masterton, West Oxford, Burnt Hill, Waimate.

Australia, Tasmania, Aru Islands.

Habits. This little Kestrel is mainly an insect eater but also feeds on mice, lizards and birds. It nests in a hollow tree or a hole in a bank or in the deserted nest of another bird.

References.—Vigors and Horsfield, Trans. Lin. Soc., 15, 183, 1827 (*F. cenchroides,* N.S.W.).

Genus Circus

Bill elevated at base, hooked at tip, lateral margin sinuated; nostrils oval. Third and fourth quills longest. Tarsus reticulate behind; outer toe longer than inner.

About twelve species found in most parts of the world.

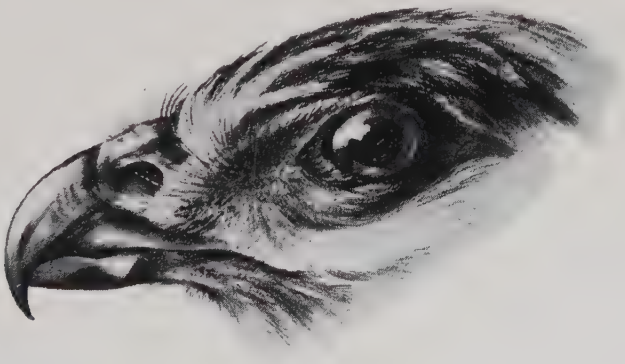
Reference.—Lacepede, Tabl. Ois., 4, 1799 (*Circus*, type *Falco aeruginosus* L.).

Harrier. Kahu

Circus approximans

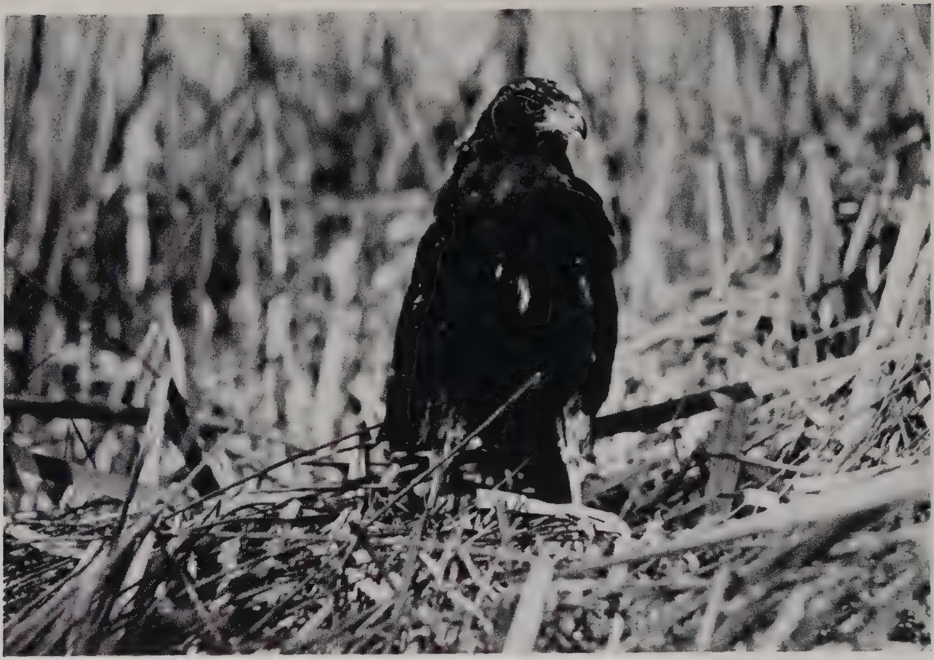
The Harrier was obtained by the Forsters in 1773 at Dusky Sound and Queen Charlotte Sound during Cook's second voyage. J. R. Forster did not describe it but left paintings, which are now preserved in the British Museum, of both young and adult birds. The Harrier is mentioned by Polack, Yate and Dieffenbach, and specimens collected by Earl in 1840 at Waikouaiti were taken to England by the British Antarctic Expedition under the command of Sir James Clark Ross. The specific name *approximans* was, however, based on specimens obtained in Fiji by Peale, ornithologist to the American Exploring Expedition.

Adult Male. Upper surface dark brown, the feathers of head and neck margined with reddish fulvous, and the wing coverts and scapulars with pale rufous; quills black, the outer webs silvery grey; upper tail coverts white barred subterminally with rufous brown; tail silvery brown with transverse bands of dark brown, the lateral feathers washed with rufous. Under surface pale rufous streaked with rufous brown, tibiae paler and with narrower streaks; under surface of wings and tail light fawn colour varied with grey; axillaries pale rufous barred with darker. Bill bluish black. Cere whitish blue. Iris sulphur-yellow. Feet lemon-yellow, claws black. Bill 25-32, wing 399-430, tail 220-255, tarsus 95, mid toe 52-64 mm. The plumage of the Harrier becomes paler with each moult. There is a general loss of the reddish fulvous colour, white taking its place. In old birds the under surface becomes white with narrow reddish brown streaks; quills silvery grey except the ends of the primaries which are dark brown; tail silvery grey with brown marks towards the end and base. *Adult Female.* Larger; colour a shade lighter, with paler edgings on the scapulars and wing coverts. Wing 433-444, tail 251-261 mm. *Immature.* After the first moult the white patch on the hind neck becomes larger; the crown feathers show buffy edges; the wing coverts and upper tail coverts have rufous margins; and the banding on the tail is more conspicuous. The under surface becomes lighter with brown streaks. Bill and feet greenish yellow. Iris brown. The fully fledged adult plumage is assumed after the second moult. *Juvenal.* Upper surface dark brown, hind neck varied with white and



Lily A. Daff

HARRIER



G. A. Buddle

HARRIER JUVENAL PLUMAGE

rufous; quills dark brown tipped with pale fulvous; tail dark brown, the end darker and tipped with fulvous, the feathers very faintly banded with lighter brown; upper tail coverts rufous brown, whitish at the base. Under surface reddish brown, the shafts of the feathers black, thighs rufous. *Nestling* covered with thick buffy white down, darker above. Bill and legs yellow.

Eggs. Clutch four, broadly elliptical, white, 52.5 x 39.5, 52 x 39 mm. Waimakariri River.

Status. Various attempts to define subspecies have been made, mainly based on size, but there is no good evidence for subdividing the species either on size or on coloration. Amadon recognises two subspecies stating that they differ only in size. Some of the ranges in size overlap.

Distribution. Kermadec Islands, Three Kings Islands, North and South Islands, Poor Knights, Mokohinau, Hen and Chickens, Little and Great Barrier Islands, Kapiti, Stewart Island and adjacent islets including the Solanders. Chatham Islands. Visitor to Auckland and Campbell Islands. A harrier seen by A. M. Gwynn on Macquarie Island probably belonged to this species. Everywhere abundant except on the Southern Islands, and at the Kermadecs during the breeding season of the wideawake terns.

The Harrier is a regular visitor to the Kermadec Islands, 600 miles distant from the North Cape. It leaves New Zealand from the end of March and returns in September and October. There is little doubt that it would remain and breed there but for the attacks of wideawake terns.

Australia, Tasmania, New Guinea, New Caledonia, Loyalty Islands, New Hebrides, Fiji, Tonga, Society Islands. Visitor to Lord Howe and Norfolk Islands.

Ecology. The Harrier is a bird of the open country—fernland, scrub, swamps, sand dunes, tussock grassland and sea coast. It is not so often seen over forest but is not absent even in heavily forested country. It has for example been observed at Milford, Chalky and Dusky Sounds. It has been observed at an altitude of 3,000 feet on Mount Egmont and the Craigieburn Range. The advent of Europeans has resulted in a large increase in the type of country in which Harriers flourish. Much forest has been destroyed and open, mostly grassland country has taken its place. An increase in the Harrier population naturally resulted but led to more destruction by shooting and trapping. To quote Guthrie-Smith: "The spread of open land has revealed to the Harrier insects and reptile life formerly unknown in the land—frogs by the edges of water holes, crickets below the dry cattle droppings. Lastly the stocking of the run has supplied to the Harrier mutton on a great scale."

Regarding the congregation of Harriers during the non-breeding season Stead has this to say: "As soon as the nesting season is over Harriers begin to collect on certain roosting grounds. For this purpose they usually choose a patch of swampy ground, covered with rushes or cutty grass; though an area of long rough grass or short scrub will serve the purpose equally well. Here they spend the night, sitting on the ground, the exact spot where they sit being clearly indicated by their droppings, and the quantity of white down which is shed as they give their feathers a final preen before going to sleep. Sometimes great numbers—two or three hundred—will resort to a roost for the night, and in such a case they may be seen converging on it from all sides just before sunset, their flight being direct, and, as a rule, at no great altitude. They continue to use such roost until August, and then, when mating begins, the paired birds sleep in the neighbourhood of the site they have chosen for a nest."

Harriers soar over the country in wide circles with a slow steady flight, remaining on the wing for hours without apparent fatigue. They are often attacked by smaller birds. They have even been killed by the introduced Australian magpie.

Although much reviled and persecuted, the Harrier is not such a bad friend to the agriculturalist. It destroys large numbers of rats, mice and young rabbits besides many insects, and it has been known to kill a stoat. As long ago as 1871 Potts recorded that upwards of 1,000 Harriers per annum were killed on the Cheviot Hills station, and "it will not create surprise to learn that on this run rats are most abundant." The predatory habits of the Harrier frequently bring it into conflict with man, especially if it is his business to rear animals. The Harrier attacks and sometimes kills young lambs and eats the lips, tongues and eyes of cast sheep. Sportsmen think its most serious crime is to kill pheasants and their young for which purpose it hovers about game farms. The presence of great numbers of Harriers, writes Stead, is one of the chief difficulties in the way of establishing game birds in open country in New Zealand.

The Harrier has killed chickens and even full grown pullets. Its relation to the native fauna, feeding on small birds, and killing tuataras on Stephen Island, must also be listed among its harmful qualities.

Food. All kinds of animal food, taken either alive or dead, are acceptable to the Harrier. Although it is not so bold as the Bush Hawk, indeed, it is somewhat of a coward, it sometimes attacks fair-sized birds such as gulls, ducks and pukeko. More often its quarry is a smaller bird or young

E. F. Stead

HARRIER PICKING UP FOOD FROM WATER

birds, besides which its food consists of lizards, insects, worms, spiders, birds' eggs and fish. It kills considerable numbers of young petrels on their breeding grounds, and young wideawakes on the beach at Raoul Island after the adult birds have departed. It is known to catch mullet, eels and trout.

The Harrier's method of catching fish and frogs in pools left by receding rivers is thus described by Stead: "On one occasion, when the Selwyn was drying up fast, and the rapidly diminishing pools were crowded with small trout—fish up to nine inches long—a large flock of Gulls and Harriers was gathered to the feast. Many Gulls were swimming about and striking with their beaks at the frightened fish, while in the shallow water around the edge some Harriers waded 'knee-deep,' grabbing with their feet at the fish that the Gulls drove past them; and out on the shingle sat a number of satiated birds, awaiting with impatience the time when their overloaded stomachs would have room for more. . . . This walking in water after food is quite a usual procedure with Harriers, and I have frequently seen them do it in shallow pools on the Waimakariri river-bed. . . . Harriers walk in the slime, and, balancing themselves on one foot with the aid of their wings, catch with the other any tadpoles they may flush."

The Harrier always strikes birds with its talons and plucks them before eating them. Sometimes it has regular feeding tables. Once I found on the Poor Knights the dining place of the Harrier on a flat-topped shrub. Here were strewn skulls and bones of numerous dove petrels together with the spiny legs of a large weta (*Deinacrida*). Almost always the Harrier takes its prey off the ground or from the surface of water, but it has been recorded as catching birds on the wing, especially small birds underneath which it flies and so forces upwards until there is an opportunity to strike. Always its talons are used to seize its prey or to pick up food. This method is well shown in Stead's remarkable photograph, reproduced here, of a Harrier picking up a floating carcase.

Nesting. The Harrier breeds in almost any convenient place near swamps, in the wide river beds of the plains, in tussock country or even in cultivated fields. Often the nest is placed on a large tussock of toetoe (*Arundo*), but may be supported by a clump of dead raupo (*Typha*) or fern (*Pteridium*). It is generally placed on or near the ground, but it has been reported as having been found in trees. The nest is usually constructed of grass, including the lining, but sticks and toetoe stems, and flax and cabbage-tree leaves are used especially in swamps where such material is available. The nest is large and rather untidy, about three feet across. As the same nest is used for more than one season it increases in size each time it is used. According to Stead the Harrier pulls up tussocks with its bill and carries them to its nest in its feet. Building, says Stead, takes about a fortnight, the hen doing all the work and adding more material after the eggs are laid. Guthrie-Smith described a nest made entirely of bones of the kuaka or diving petrel.

The eggs of the Harrier are laid during the months of October, November and December. The following summary of an article published by Stidolph shows that the incubation period is about 33 days: Novem-

Opaki *R. H. D. Stidolph*

HARRIER NESTLINGS

ber 15: Four eggs just laid. December 10: One egg hatched. December 13: Two more eggs had hatched. December 18: Last egg had hatched. December 26: Smallest young had disappeared, the other three had grown considerably in size. Largest had wing and tail feathers showing. January 8: One young scrambled out of the nest.

As the eggs of the Harrier are frequently laid at intervals of several days and hatched at corresponding intervals young of various ages are found in the same nest. Stead records a case where the bird began to sit on three eggs and then laid four more at intervals afterwards, the last a few days before the first egg hatched. Guthrie-Smith states that usually only the two first hatched nestlings leave the nest, the younger ones, he believes, are "torn to pieces and devoured by the larger chicks." He also states that, on being disturbed, Harriers will desert the nest and leave the young to die. The young stay in the nest about six weeks by which time they are fully fledged and ready to fly.

References.—Peale, U.S. Expl. Exped., Birds, 64, 1848 (*C. approximans,* Fiji). Buller, Birds N.Z., 11, col. pl. 1872; 2nd ed., 1, 206, col. pl. 1888; Suppl. 2, 54, 1905. Buddle, Bird Secrets, 34, 1951. Guthrie-Smith, Birds, Water, Wood, Waste, 99, 1910. Mathews and Iredale, Ibis, 1913, p. 419 (*C. a. drummondi,* New Zealand). Stead, Life Histories N.Z. Birds, 106, 1932. Amadon, Emu, 40, 365, 1941.

White-bellied Sea Eagle
Haliaetus leucogaster (?)

From time to time it has been reported that eagles have been seen in New Zealand. All the reports may not, of course, refer to the same species. No specimens have been taken unless that in the Dominion Museum really was shot in New Zealand. In 1866 Haast, when camping on Mount Harman at the headwaters of the Rakaia River, saw at close range on more than one occasion what he described as a very large bird of prey as large as a good sized eagle. Mr. R. Norman tells me that there was an eagle in the Matukituki bush about 1870. In 1873 Buller stated in his *Birds of New Zealand* that Mr. Gould had presented him with a beautiful specimen of a White-bellied Sea Eagle said to have been procured in New Zealand. The specimen is now in the Dominion Museum. Buller further said that an army officer assured him that he had actually seen and fired upon a Sea Eagle on the rocks near the entrance to Wellington Harbour. Dr. K. E. Crompton of Havelock North told me that, about 1935, from the summit of Turangakumu, he saw two eagles soaring in circles high up in the sky. Some years ago Mr. G. Hayter of Takaka told Mrs. Moncrieff that he saw a bird as large as a collie dog resembling a huge bird of prey. Now come reports, collected by Mrs. Moncrieff, from four localities in Nelson and Marlborough that an eagle approximately answering to the description of the White-bellied Sea Eagle has been seen. The first report, March, 1953, was from two deer stalkers, A. G. Chapman and D. Patterson, who saw an "immense bird" in the Kawatiri district, Nelson. It was described as "a bird with lightish grey brown breast and dark brown upperparts, the tips of the wings being darkest with touches of white when outstretched." A description of what was almost certainly the same bird seen by two men in Dashwood Pass, Marlborough, is as follows: "The neck was bald or covered with very slight feathers. The back of the neck and half the bird's body was grey." Both these recent accounts could well refer to the White-bellied Sea Eagle. Other reports come from C. Flower of Gowanbridge (not far from Kawatiri) and McCrea of Tutaki, in the same district.

The following is a brief description of the White-bellied Sea Eagle: Head, neck, under surface, lesser under wing coverts and terminal part of the tail white; back and rump dark ashy grey becoming darker on the upper tail coverts; scapulars and upper wing coverts slate colour; quills and basal portion of the tail blackish grey. Bill lead colour. Feet yellow, claws dark. Length up to 28 inches, bill two; wing from carpel flexure to tip 22-24; expanse of wings six feet eight inches. The young bird is of a chocolate brown colour with the head and under surface buff brown.

ORDER STRIGIFORMES

OWLS

Bill strongly hooked; provided with a cere at the base. Nostrils hidden by stiff bristles. Eyes directed forwards and surrounded by a facial disc of feathers. Tarsus feathered; outer toe reversible.

Comprises two families of which Tytonidae is represented in New Zealand only by an accidental occurrence.

Key to Families

Eye near middle of facial disc	*Tytonidae*
Eye above greater part of facial disc	*Strigidae*

FAMILY TYTONIDAE

Eye near middle of facial disc. Inner margin of claw on middle toe serrated. Sternum not notched behind, keel joined to furcula.

GENUS TYTO

Characters of the family. Cosmopolitan. Nine species with many subspecies.

Reference.—Billberg, Syn. Faun. Scan., 1, tab. A, 1828 (*Tyto*, type *Strix alba*).

Barn Owl

Tyto alba delicatula

The Australian Barn Owl is admitted to the New Zealand fauna on the evidence of a single adult female shot by J. Langridge at Barrytown, Westland, on August 16th, 1947.

Adult. Facial disc silky white, the outer feathers on the lower side with deep brown tips, on the upper side with pale brown tips. Upper surface buffy white closely freckled with brown and marked with longitudinal lines of brown and white, the basal half of these feathers being brown, the apical half white; wing coverts with irregular patches of buff and of white; tail crossed by four brown bands. Under surface including wing coverts silky white with scattered dark brown flecks except on the thighs. Bill ivory. Feet buff, soles and sides of toes buffy brown, claws dark brown. Bill 21, wing 295, tail 135, tarsus 60, mid toe 40 mm. Barrytown.

Eggs. Clutch 3-7, oval, white. 41.4 x 31.2, 44 x 30.7 mm. Australia.

Distribution. Barrytown. One occurrence. Australia. Solomon Islands. The species is cosmopolitan and comprises 34 subspecies.

Habits. In Australia the Barn Owl ranges over all kinds of country from forest to the mulga scrub of Central Australia. It feeds on insects to a certain extent but mainly on small mammals such as bats, mice and rats, and on small birds. Usually it nests in a hole in a tree.

References.—Scopoli, Ann. Hist. Nat., 21, 1769 (*Strix alba*, Italy). Gould, Proc. Zool. Soc., 1836, p. 140, 1836 (*Strix delicatula*, New South Wales).

FAMILY STRIGIDAE
HORNED AND WOOD OWLS

Eye near upper border of facial disc. Inner margin of claw of middle toe not serrated. Sternum notched behind, keel free from furcula.

Key to New Zealand Genera

Tarsus slightly longer than middle toe	*Ninox*
Tarsus nearly twice length of middle toe	*Sceloglaux*

Genus Ninox

Bill strongly hooked, the tip sharp pointed. Third and fourth quills longest. Tail long, slightly rounded. Tarsi slightly longer than middle toe and claw.

Distinguished by the long decurved and sharp-pointed tip to the upper mandible and the relatively short tarsus.

About 18 species ranging from India, China and Japan southwards to Australia, Tasmania and New Zealand.

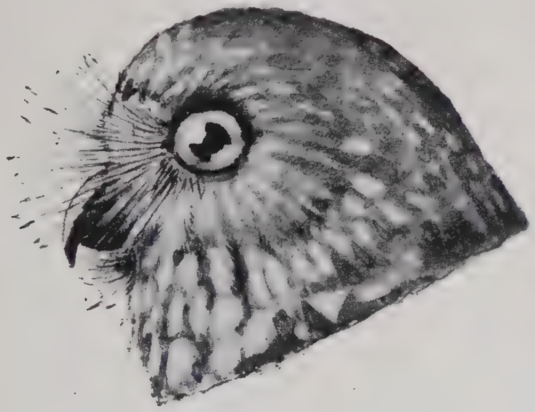
Reference.—Hodgson, Madras Jour. Lit. Sci., 5, 23, 1837 (*Ninox,* type *N. nepalensis,* Hodg.).

New Zealand Owl. Morepork. Ruru

Ninox novaeseelandiae novaeseelandiae

The Morepork was discovered by Forster at Queen Charlotte Sound during Cook's second voyage. Forster's drawing led to Latham's description of the "New Zealand Owl," and so to the specific name adopted by Gmelin. In 1827 the French naturalists, Quoy and Gaimard, of the *Astrolabe* expedition found the Morepork in Tasman Bay, to the westward of the locality where Forster met with it. In the North Island it was noted at the Bay of Islands by Yate in 1835 and collected there in 1840 by Titian Peale of the United States Exploring Expedition. The following year the British Expedition in the *Erebus* and *Terror* obtained it at the same place.

Adult. Upper surface dark chocolate brown, with radiating fulvous stripes on crown, faintly spotted with fulvous on the hind neck and back, and with white on the scapulars and wing coverts; quills and tail feathers dark brown obscurely banded with fulvous brown. Facial disc greyish white, the feathers with black shafts, the whole disc bordered with fulvous, over the eyes white with black spots. Under surface fulvous longitudinally striped with dark brown; thighs and under tail coverts mottled brown, white and ochraceous; tarsi and toes fulvous with dark lines. Bill black, the culmen white. Iris yellow. Bill 20-22, wing 185-200, tail 130-145, tarsus 32-35, mid toe 32 mm. *Nestling.* When hatched the down is slaty grey. This lengthens and within a week becomes white. The second down is long, dark brown above with a few buff spots and mottled buff and brown below. The first down remains attached to the second down for some time the head being the last part to lose it. *Colour Varieties.* Albinos and partial albinos have been obtained.



E. H. Atkinson

MOREPORK

Eggs. Clutch two, occasionally three, broadly elliptical, white, smooth. 37.5 x 32.5, 38.5 x 34.5, 39 x 34 mm.

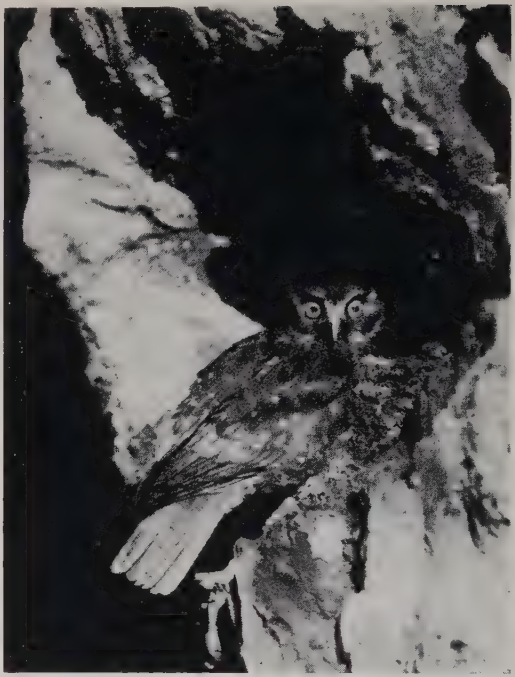
Status. Mathews and Iredale recognised two subspecies in New Zealand, one, *N. n. venatica,* lighter, in the North Island, and the other, *N. n. novaeseelandiae,* darker, in the South Island. But the differences, even if constant, are hardly sufficient to admit subspecies. Peters includes in this species as subspecies 15 forms ranging from the Sunda Islands to Australia, Tasmania, New Zealand, Lord Howe Island and Norfolk Island.

Distribution. North, South and Stewart Islands. Three Kings, Mokohinau, Hen and Chickens, Little and Great Barrier Islands, Mayor Island, Kapiti, Codfish and other islands off Stewart Island.

Ecology. In the daytime, deep shady forests are the usual haunts of the Morepork, unless it is hiding away in a hollow tree or cave. No doubt it is avoiding the bright light but there is less likelihood of being found by small birds which would immediately mob it. In the evening, however, the Morepork is wide awake and takes toll on any unwary birds that expose themselves. The Morepork has taken kindly to the settled districts and may be found in plantations or gardens sometimes right in the larger cities. It has invaded the exotic pine forests of the Whakarewarewa and Kaingaroa Plains districts.

Though probably we will always have the Morepork with us, its numbers have decreased with the destruction of the forest. Its worst enemy is the introduced Little Owl which is displacing it in parts of Otago. Wild cats are said to catch Moreporks occasionally. The practice of mobbing by small birds worries the Morepork a little but is not known to cause any deaths at any rate among the Moreporks. Notwithstanding its bird-eating propensities, the Morepork must be accounted a useful species to the agriculturalist. It destroys large numbers of moths and beetles whose larvae are injurious to grass, crops and timber, and it is a useful rat and mouse catcher.

Food. Mainly an insect eater, the Morepork may be seen at dusk hawking for moths and beetles on the edge of the forest. It also eats flightless species such as the weta. Lizards and spiders are also eaten and Stead once found a Short-tailed Bat in a Morepork's nest. Where rats and mice are plentiful, the Morepork is attracted and proceeds with the business of catching them with little heed of the presence of man. Rats are skinned from the neck backwards. To hold a rat for this process the head may be wedged in the fork of a tree or the Morepork may hold the rat's head with its talons. Lastly it must be mentioned that the Morepork feeds on small birds and their eggs. Among the kinds of birds eaten are sparrows, thrushes, starlings, kingfishers, silvereyes, fantails, whiteheads, saddlebacks and bellbirds. On Little Barrier Island feathers of the Stitchbird have been found in the disgorged pellets of the Morepork, and on the islands off Stewart Island Diving Petrels and White-faced Storm Petrels are regularly taken by Moreporks to feed their young. According to Stead the Morepork may hold its prey in one foot to eat it, after the manner of a parrot, or if it is large stand on it with both feet and tear pieces off. At the Three Kings Turbott and Buddle record the Morepork as feeding on brown geckos and bellbirds.



Kapiti Island *A. S. Wilkinson*

MOREPORK

Voice. The characteristic call of this owl, and the one from which it receives its name, is "morepork" in rather a high-pitched note and repeated often many times in quick succession. It utters various other cries the most common of which may be rendered "ow-ow-ow" and "cree-cree."

Nesting. The Morepork usually selects for the site of its nest a hollow tree but other situations such as dense foliage, caves, or even the clusters of dead pine needles in the fork of a tree are sometimes chosen. Stead records finding a nest on the ground on Cundy Island, off Stewart Island. Two, very rarely three, eggs are laid in October and November.

On Stewart Island Guthrie-Smith watched the Moreporks feeding their young. "Morning after morning," he writes, "we found in the nest sometimes one and sometimes two newly-slain diving petrels. At first the parent birds rend the flesh from the bones, and feed it to their brood, but afterwards allow the chicks to help themselves." Regarding the Morepork's habit of keeping a stock of food for the young owls Stead says: "There is usually a supply of food kept in the nest, on which the young are fed from time to time during the day. Often, too, there is a larder near by, in which an extra store of food is kept. On Solomon Island there was a Morepork's nest in a hollow rata, and, besides the collection of food which was in the nest with the young, there was usually a dead diving petrel or some other bird laid on a ledge of the tree outside the nest."

Maori. Although occasionally eaten, the Morepork was not much sought after by the Maori. Elsdon Best thus explains why certain Maori carvings have large glaring eyes: Rongo, who presided over the art of agriculture, acquired his knowledge of carving in the realm of Rangitamaku, the second of the twelve heavens. When he constructed his own house he used Koururu (personified form of the owl) as a sacred offering, and buried his body under the rear wall of the house. That is the reason why carved figures have large glaring eyes, they are the eyes of Koururu.

References.—Gmelin, Syst. Nat., 296, 1788 (*Strix novaeseelandiae,* Queen Charlotte Sound). Quoy and Gaimard, Voy. Astrol. Zool., 1, 163, col. pl. 1830 (*Noctua zelandica,* Tasman Bay). Peale, U.S. Expl. Exped., Birds, 75, 1848 (*N. venatica,* Bay of Is.). Buller, Birds N.Z., 17, col. pl. 1872; 2nd ed., 1, 192, col. pl. 1888. Guthrie-Smith, Bird Life, 116, 1925. Stead, Life Hist. N.Z. Birds, 16, 1932. Cunningham, N.Z. Bird Notes, 3, 22, 1948. Wilkinson, Kapiti Bird Sanct., 42, 1952.

GENUS SCELOGLAUX

Bill stout, hooked at the tip, third and fourth quills longest. Tail long, slightly rounded. Tarsus nearly twice as long as middle toe and claw.

Sceloglaux differs from Ninox in its relatively longer tarsus and in the form of the bill, the tip of the upper mandible being less curved and not so sharply pointed. There is a single species confined to New Zealand.

Reference.—Kaup, Isis, 1848, col. 768 (*Sceloglaux,* type *Athene albifacies* Gray).

Laughing Owl. Whekau

Sceloglaux albifacies albifacies

One of the earliest collectors of birds in New Zealand was Percy Earl who forwarded his specimens to the British Museum where they were reported on by G. R. Gray in his account of the birds of the *Erebus* and *Terror* Expedition, published in 1845. One of these specimens was an example of the Laughing Owl obtained at Waikouaiti and which Gray characterised as a new species. Although the species was then fairly abundant, few specimens have since been collected and within 40 years of its discovery it had practically disappeared.

Adult. Upper surface dark brown with longitudinal bands of fulvous, each feather with a broad brown centre almost to the tip and broad edgings of fulvous; greater coverts dark brown edged and notched with fulvous; quills dark brown banded with fulvous; tail dark brown with five bands and the tip of each feather fulvous white. Facial disc narrow above eyes, broad below and behind the eyes, greyish white, the feathers with dark shafts; under surface deep fulvous broadly banded longitudinally with dark brown, the fulvous deepening on the lower abdomen and thighs; legs pale ochraceous. Bill bluish grey, yellowish at tip and along cutting edge, cere pale greenish yellow. Iris dark brown. Toes pale yellow, claws dark horn. Bill 25, wing 260-280, tail 165, tarsus 64-67, mid toe 38-42 mm. The facial disc is variously described as sandy brown, palish brown, dark grey, and white. Rowley figures a bird with a rufous centre to the disc.

Eggs. Clutch two, broadly elliptic, blunt at both ends, white, 51.5 x 43, 48 x 41 mm.

Canterbury. 44 x 39.4 mm. Opuha. 46.8 x 38.5 mm. Opihi River.

Status. Two subspecies are recognised, one in the South Island, *S. a. albifacies,* with dark brown and fulvous plumage, and the other in the North Island, *S. a. rufifacies,* with a similar pattern of plumage but with a rufous tinge over the whole body.

Distribution. Formerly plentiful in Nelson, Canterbury and Otago, now almost extinct; recently reported from Canterbury and Lakes Te Anau and Wanaka in Otago. In a subfossil state bones have been found at Pyramid Valley, Lake Grassmere and Earnscleugh Cave.

Ecology. The Laughing Owl was, as far as is known, more a bird of the open country than the forest. It was found in rocky places on the Southern Alps and the downs of Canterbury and Otago. Its home was in rock crevices and caves, often narrow fissures in limestone rocks where both birds and eggs were only with difficulty obtained.

W. W. Smith who, more than anyone else, knew the nesting places and habits of the Laughing Owl, formed the opinion that ferrets and weasels, introduced for killing rabbits, contributed largely to its disappearance. Some of the districts where the birds were found are now closely settled and so there would inevitably have been a reduction in numbers. Buller thought that the disappearance of the Laughing Owl was due to a decrease in its main food supply, the Maori rat, after the introduction of the brown rat.

Food. From the castings found in the rock crevices where these birds resorted, W. W. Smith ascertained that their food consisted of beetles, lizards and the native rat.

Voice. Potts' description of the call of this owl is a "loud cry made up of a series of dismal shrieks frequently repeated." It is this weird cry which has earned for it the name Laughing Owl. This outburst, according to W. W. Smith, is only heard when the birds are on the wing and generally on dark and drizzly nights, or immediately preceding rain. The call of the adults in the evening is like two men cooeeing to each other.

Nesting. A nest discovered by C. Richardson at Albury in January was in a crevice in a limestone cliff and consisted of a small quantity of dry grass. Nests were also found in the same locality by W. W. Smith who states that the birds begin to breed in September. Both parents share the work of incubation which takes 25 days and the young are fed on worms.

References.—Gray, Zool. Erebus and Terror, Birds, 2. col. pl. 1845 (*Athene albifacies,* Waikouaiti). Rowley, Orn. Misc., 1, 35, col. pl. 1875. Potts, Trans N.Z. Inst., 3, 63, 1871. Smith, N.Z. Jour. Sci., 2, 86, 1884. Buller, Birds N.Z., 21, col. pl. 1872; 2nd ed., 1, 198, col. pl. 1888; Suppl., 2, 62, 1905.

Rufous Laughing Owl. Hakoke

Sceloglaux albifacies rufifacies

This North Island representative of the Laughing Owl was known to the Maoris who said that it was once found in several districts. Only two specimens have been collected by Europeans. One was procured by a taxidermist named Martin on Mount Egmont about 1856, and a second was taken in the Wairarapa district in 1868. The first specimen went into a private collection and cannot now be traced. The Wairarapa bird was used by Buller for the diagnosis of his species *Sceloglaux rufifacies* and now, presumably, is in private hands.

Adult Female. Similar to *Sceloglaux a. albifacies* but smaller and the whole plumage strongly suffused with rufous blotched with dark brown in the same pattern as in the typical subspecies. Facial disc rufous brown; crown and nape blackish brown longitudinally streaked with rufous; quills dark brown with regular transverse bars and a terminal edging of rufous; tail missing. Bill lemon yellow. Iris dark brown. Feet dull yellow. Bill 25, wing 266, tarsus 57, mid toe 51 mm.

Status. The overall rufous colouring of this form and its slightly smaller size distinguishes it from *S. a. albifacies* of the South Island. Had there been a series of specimens it is possible that a case for specific status might have been made, but the only specimen handled by an ornithologist was a female that had moulted and may not have been fully adult. The tail had been removed by the taxidermist, presumably because it was imperfect, and replaced by a tail of an Australian species of *Ninox*.

Distribution. Mount Egmont. Wairarapa. Possible sight records, Little Barrier Island, Porirua and Te Karaka (East Coast district). According to Maori information formerly plentiful in the Urewera district. G. J. Garland states that the Laughing Owl was found in the Kaimanawa Range in 1890.

References.—Buller, Ibis, 1904, p. 639 (*Sceloglaux rufifacies*, Wairarapa); Suppl. Birds N.Z., 2, 65, col. pl. 1905. Rothschild, Extinct Birds, 77, 1907.

ORDER GALLIFORMES

GAME BIRDS

Bill short, stout, the culmen arched and overhanging the lower mandible. Hind toe always present. Nestling hatched covered with down and able to run in a few hours.

FAMILY PHASIANIDAE PHEASANTS, QUAIL

Nostrils never hidden by feathers. Tarsi partially or entirely naked, and often armed with spurs; toes naked, never pectinate.

Genus Coturnix

Bill short, arched, nostrils covered by a membrane. Second and third quills longest. Tail short, soft, covered by upper tail coverts, 10 to 12 feathers. Tarsi without spurs.

Closely allied to Synoicus but distinguished by the long white axillaries, second and third quills being longest, and the first three quills forming the tip of the wing.

Five species ranging over the eastern hemisphere.

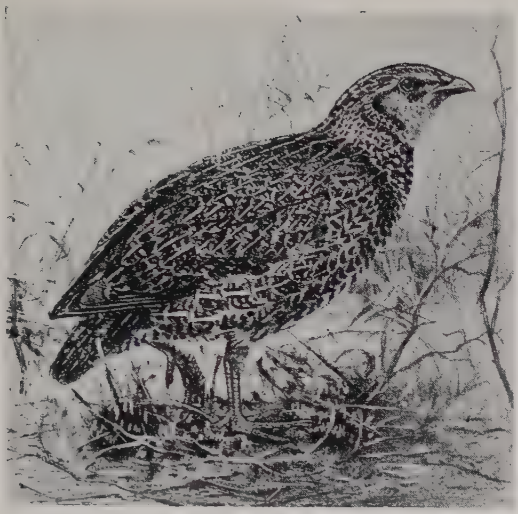
Reference.—Bonnaterre, Tabl. Encyl. Meth., 1, 216, 1791 (*Coturnix,* type *Tetrao coturnix* L.).

New Zealand Quail. Korekē

Coturnix novaezealandiae

Sir Joseph Banks in his Journal of Cook's first voyage mentioned quail as having been seen in New Zealand in 1769 or 1770, and shortly afterwards, in 1772, Crozet found them to be very common at the Bay of Islands. Forster reported them in Queen Charlotte Sound in May, 1773, during Cook's second voyage. The first specimen to be collected and described, however, was obtained in 1827 near the River Thames by Quoy and Gaimard, naturalists to the French exploring expedition under d'Urville, which visited New Zealand in the *Astrolabe*. About 1840, Dieffenbach in the North Island and P. Earl in the South reported the quail as not common. I can find no report of it ever being abundant in the North Island since Crozet's time. It was taken at Whangarei in 1860 by Captain Mair and last reported as being seen in Taranaki in 1869. In the South Island it was everywhere reported as abundant until about 1865 when it suddenly decreased. The last specimens known to be taken were those formerly in Buller's collection obtained at Blueskin Bay in 1867 or 1868. In 1872, Buller thought that the species was still occasionally to be found in the South Island. All observers agree that the cause of the extinction of this quail was mainly fires which destroyed food and cover as well as the birds. Introduced mammals such as dogs, cats and rats were also contributory factors.

Adult Male. Top of head dark brown, a series of feathers in centre and each side with central yellowish white stripe; upper surface rufous brown varied with black and striped with white; primaries and outer secondaries dark brown, the latter rayed on their outer webs with pale brown; inner secondaries, wing coverts and tail feathers greyish brown varied with rufous and with narrow white shaft lines. Sides of face and throat rufous; black spots under the eye to gape; a dark band through the eye turning downward as a border to the rufous on side of the throat. Lower neck mottled black and white; flanks rufous brown, the feathers with white central streak bordered with black, webs barred with black. Abdomen fulvous white; under tail coverts fulvous white barred with black. Bill black. Iris hazel. Feet pale flesh colour. Bill 12, wing 110, tail 40, tarsus 25, mid toe 32 mm. In old specimens the breast is almost black with



From Buller, Birds of New Zealand
NEW ZEALAND QUAIL

splashes of fulvous white. *Adult Female.* Similar to male but lighter; no rufous colour on face or throat; throat and foreneck ferruginous brown, abdomen almost buff. *Immature* similar to adult female.

Eggs. Clutch 10 to 12, ovoid, pointed, brownish white, with dark brown blotches and underlying paler ones all over; variable in shape and size, 29.4 x 23.8, 28.5 x 23 mm. Windwhistle. 33.2 x 23.5 mm. Mount Peel.

Status. Closely related to the Australian *C. pectoralis* and sometimes included with it as subspecies of a single species but it should perhaps be separated on biological grounds as *C. pectoralis* is dimorphic, two subspecies having been named, while *C. novae-zealandiae* was so far as we know unitary. In *C. novae-zealandiae* the general coloration is more intense, the black and rufous being more conspicuous. The rufous colour on the throat is not so extensive as it is in *C. pectoralis,* there is a more definite black band bordering the rufous on the side of the neck while the feathers on the flanks are conspicuously barred with black.

Distribution. North and South Islands, Great Barrier Island. Formerly abundant. Extinct since about 1870.

Habits. Very little information has been left on record regarding the habits of this now extinct species. From the writings of Potts and Buller we gather that it was abundant in open grass land; its food consisted of seeds and grass; its nest was a depression in the ground, lined with grass; the eggs took twenty-one days to incubate, and the young were active from the day they were hatched.

The European settlers shot it in large numbers, but the Maori, before the advent of the Europeans, caught it with nets and snares.

References.—Quoy and Gaimard, Voy. Astrol. Zool., 1,242, col. pl. 1830 (*C. novae zealandiae,* Hauraki Gulf). Potts, Trans. N.Z. Inst., 3, 92, 1871. Buller, Birds N.Z. 161, col. pl. 1872; 2nd. 1, 225, col. pl. 1888; Suppl. 1, 35, 1905. Rothschild, Extinct Birds, 183 col. pl. 1907.

ORDER COLUMBIFORMES

PIGEONS

Bill swollen at the tip, tumid at the base. Hallux on same level as other toes. Tarsi reticulate, usually feathered on upper part.

FAMILY TRERONIDAE
FRUIT PIGEONS

Bill decurved at tip. Tarsus generally shorter than middle toe, feathered more than half its length; all toes expanded on the sides.

Genus Hemiphaga

Bill with long dertrum, base distended. Third and fourth quills longest. Tail long, rectrices 12.

Differs from all other members of the family in having only 12 feathers in the tail. Three species, one in New Zealand, one in Norfolk Island, and one in the Chatham Islands.

Key to New Zealand Species

Outer upper wing coverts and rump green	*H. novaeseelandiae*
Outer upper wing coverts and rump grey	*H. chathamensis*

Reference.—Bonaparte, Compt. Rend., 39, 1076, 1854 (*Hemiphaga*, type *Columba novaeseelandiae* Gmel.).

New Zealand Pigeon. Kereru
Hemiphaga novaeseelandiae

This beautiful and formerly excessively abundant species so attracted visitors that it was noticed and recorded by all the early explorers. Crozet, who visited the Bay of Islands in 1772, writes: "In the forests are very beautiful wood pigeons about the size of a pullet, their sparkling blue and gold plumage is magnificent." The following year it was collected by Forster at Dusky Sound during Cook's second voyage. This led to its first introduction to ornithology. Forster made a painting of it, Latham described it, and Gmelin gave it a scientific name. The only bird that impressed Savage in 1805 was a "pigeon of beautiful plumage, large size and delicious eating."

In 1824 Lesson, one of the naturalists to the French surveying ship *Coquille*, met with this pigeon at the Bay of Islands. In the same locality, in 1839, Titian Peale, who accompanied the United States Exploring Expedition, stated that great numbers were found in woody districts, and the British Antarctic Expedition under Sir James Ross also, in 1841, collected it at the Bay of Islands. Yate, writing in 1835, refers to this pigeon's plumage as unrivalled for splendour and variety and also, alas, to it being most delicious eating. In the South Island a specimen, apparently a colour variety, was obtained at Akaroa in 1839 and about this time P. Earl observed the species at Tautuku and the Molyneux River in Otago.

Adult. Head, neck and upper breast shining golden green with coppery reflections; nape, back, scapulars and smaller wing coverts chestnut-purple with coppery reflections; lower back, rump and short upper tail coverts greyish metallic green; long upper tail coverts bronze green; outer upper wing coverts and quills metallic bronze green; tail brown with green lustre. Lower breast, abdomen, tibiae and under tail coverts white. Bill crimson on basal half, yellowish on outer half. Iris brownish red, eyelid pale red. Feet dull lake, hind tarsus and soles yellowish, claws black. Bill 16-19, wing 250-267, tail 190-205, tarsus 25-30, mid toe 40-55 mm. *Nestling* sparsely covered with brownish yellow down; lower surface bare; space round eye bare. Bill dull flesh. Feet leaden to flesh colour. *Colour Varieties.*

The Pigeon seems particularly prone to colour variations, the ordinary colours giving place to grey, brown or white, in varying proportions. In some specimens the green is replaced by yellowish brown or light brown. The coppery colour of the upper back is the most persistent, perhaps because it is due to a pigment. White may be present as scattered feathers and patches, sometimes single feathers being partly white, or the entire plumage may be white.

Eggs. Clutch one, ovoid, white, smooth. 48.2 x 32, 48.5 x 33.6 mm. Taranga Island. 47.6 x 30.8 mm. Three Mile Bush, Westland.

Status. The New Zealand Pigeon differs from the Chatham Island Pigeon in its smaller bill, absence of grey in its plumage and in the under tail coverts being white. In the absence of grey it differs likewise from the Norfolk Island Pigeon, *H. argetraea,* which appears to be more closely allied to the Chatham Island Pigeon than to the New Zealand one.

Distribution. North and South Islands. Little and Great Barrier Islands, Hen and Chickens, Mayor Island, Kapiti, Chetwode Islands, Stewart Island, Codfish Island. Pigeons thought to belong to this species formerly inhabited Raoul Island, but no specimens have been preserved.

Ecology. The Pigeon is one of the most characteristic birds of the New Zealand forest, firstly, because it was at one time exceedingly abundant and secondly, because it shows little fear of man but unconcernedly pursues its business of feeding within close range. It is still abundant in the larger areas of forest. In small numbers it exists in settled country, for example, it is occasionally seen in Tauranga, and, according to Stidolph, it is present in some farming districts in the Wairarapa. Outlying forest remnants, even those in the far north, sometimes have their quota of pigeons.

The Pigeon has been greatly reduced in numbers by the clearing of forest. No doubt the presence of deer, pigs, goats and opossums, by destroying berry bearing shrubs, has contributed to the decrease of the Pigeon; cats have been blamed for killing Pigeons; and, lastly, its high regard as a food has been a factor in its undoing. It is pleasing to note, however, that if not

E. F. Stead

NEW ZEALAND PIGEON

molested Pigeons quickly recover their numbers. Perhaps this is due to the fact that the Pigeon closely watches over its young while they are in the nest.

Apparently seasonal migratory movements are performed by the Pigeon, the birds coming down to the low country in winter. Pigeons are somewhat erratic in their movements as they congregate wherever there is to be found an abundance of ripe berries on which to feed.

The function of the Pigeon in the life of the forest seems to be to disseminate seeds, and formerly it must have carried out this duty well, for it consumed immense quantities of all kinds of soft fruits. No possible harm can be laid to the Pigeon unless it be the distribution of noxious plants such as the sweet briar and the pulling up of a few seedlings of rape, turnip or similar field crops.

Food. An abundance of berries in the New Zealand forest throughout most of the year provides the Pigeon with its staple food. During the late winter when there are few or no berries, leaves and shoots provide sustenance but the Pigeon loses in condition. Practically every kind of native berry is eaten but the bulk of the Pigeon's food consists of the following fruits: miro, kahikatea, tawa, wineberry, hinau, konini, mahoe, puriri, maire, karaka, supplejack, karamu, taraire, nikau, ti, porokaiwhiri and matai. Of leaves and buds it is known to eat kowhai, wineberry, ribbonwood, pohuehue, mahoe, karamu, lacebark and the ferns asplenium and polypodium. Kowhai flowers are a favourite food in the early spring. The introduced plants eaten by the Pigeon include sweetbriar, holly, cherry, and rowan berries; willow, tree lucerne, clover, apple and laburnum leaves; and broom, tree lucerne and laburnum flowers.

The following calendar of the Pigeon's principal fare is taken from M'Lean's account of the East Cape district. January and February—wineberry; March—kahikatea; April—kahikatea, tawa; May—tawa, June—miro, hinau, tawa; July—hinau, karamu, supplejack, five-finger; August—five-finger; July to October—leaves of kowhai, wineberry and parsonia; November—fuchsia, porokaiwhiri; December—mahoe.

Voice. The Pigeon is usually a silent bird. The note most commonly heard is "ku," sounded rather differently to express caution or alarm. Other notes, as described by Guthrie-Smith, are: the growl of extreme anger in the hen bird, the slightly sibilant whistle of welcome, the double sound of grunt and whistle which perhaps expresses impatience, the moan coming from the bird watching the nest, and the piping of the nestling in expectation of food.

Nesting. The Pigeon builds in trees usually placing the nest between fifteen and thirty feet above the ground. It chooses a firm foundation such as a stout branch or a dense cluster of vines or twigs. Sometimes it selects a small tree overhanging a cliff. The nest looks very frail, just a platform of sticks through which the egg can easily be seen, and there is nothing that could be called a lining. The egg hollow is very shallow. The sticks, however, are intertwined in such a way that the nest serves its purpose for the long period, more than two months, from laying to the time the young leaves. The eggs are laid during several months of the year, but mostly in November and December, though eggs have been found in every month until May and in one instance a fledging seen in September must have been hatched from an egg laid in July. Guthrie-Smith discovered that some seventy days elapsed from the laying of the egg to the abandonment of the nest by the young bird. Wilkinson on Kapiti Island determined the period of incubation to be 29 days and the time the young stayed in the nest 45 days. During these periods the egg and young are closely watched by the parents. The nestling pigeon is at first fed on a milky secretion from the crop. Gradually this is replaced by berries. In feeding the young, states Guthrie-Smith, the beak of the parent overlaps that of the young and the contents of the crop are transferred with a curious swaying motion.

Maori. The Pigeon was much used as an article of food by the Maori and it was potted for future use. The feathers were used in the making of cloaks. In a single locality thousands of birds would be caught in a season. The following account of the Maori method of taking pigeons is based on the writings of Tregear. Three principal methods were employed, the tutu, spears and snares. The tutu method was to erect a platform in a tree on which the birds were feeding. The hunter, who was seated on this platform, controlled nooses on artificial perches. When a pigeon alighted on one of these the Maori pulled the noose and caught it. A spear was 30 to 35 feet in length with a bone head barbed on one side and with it the birds were speared while feeding in the tree-tops, by a Maori hidden in the foliage below. Snares were either placed in the trees or set round a trough (waka kereru) filled with water. This was either placed on posts at the feeding ground or secured to the trunk or branches of a tree. The birds become very thirsty when feeding and soon find the water which they eagerly crowd round. After they have become accustomed to drinking from the trough, snares are set closely round it. Sometimes the snares were set round a natural drinking pool, or they were set on the tree-tops where the birds were feeding.

References.—Gmelin, Syst. Nat., 773, 1789 (*Columba novaeseelandiae,* Dusky Sound). Buller, Birds N.Z., 157, col. pl. 1872; 2nd ed., 1, 229, 1888; Suppl., 1, 36, 1905. M'Lean, Emu, 11, 5, 1911. Guthrie-Smith, Birds, Water, Wood, Waste, 161, 1910. Wilkinson, Kapiti Bird Sanct., 36, 1952.

Chatham Island Pigeon. Kuku

Hemiphaga chathamensis

Though Dieffenbach in 1840, Buller in 1855 and Travers in 1871 visited the Chathams and saw this species, Travers collecting a specimen which was examined by Hutton, none noticed it to be different from the mainland species. It was, however, collected about 1890 for Rothschild, who described it as a new species. Its numbers quickly became reduced after the settlement of the islands by Europeans until it was reported as nearly extinct. Now, however, owing to the operation of the Wildlife Act it is more common.

Adult. Head, neck and upper breast deep metallic green, tinged with purplish blue on the neck and breast; back and wing coverts to bend of wing chestnut-purple with coppery reflections; marginal coverts white; central wing coverts and secondaries metallic green; outer coverts and quills grey with metallic green reflections; lower back and rump light grey; upper tail coverts green; tail deep steel-blue. Breast and abdomen white; under tail coverts green. Bill cherry red at tip. Iris and eyelid red. Feet purplish red, claws black. (Lindsay.) Bill 20-22, height at base 9-9.5, wing 268-275, tail 195-215, tarsus 26-30, mid toe 47-55 mm. *Immature.* Plumage duller and darker; under tail coverts buff. Bill and feet duller. A little down adhering to head and neck on November 29th. (Fleming.)

Eggs. Clutch one, white, glossless, length 45-49, diameter 34-35 mm.

Status. The Chatham Island Pigeon differs conspicuously from the New Zealand Pigeon in its larger bill, grey lower back, outer coverts and quills, and in the greyish green under tail coverts. In the grey plumage it resembles the Norfolk Island Pigeon, *H. argetraea* (syn. *spadicea*).

I consider that the relationships between the three pigeons are best shown by treating them as separate species. It emphasises the differences and the fact that the three forms are completely separated geographically.

Distribution. Chatham Islands: Wharekauri, Pitt Island. Formerly on Mangere but now gone.

Ecology. From being in former times exceedingly abundant the Chatham Island Pigeon, through the invasion of Maoris in 1835 and of Europeans soon afterwards, became nearly extinct about 1896. In 1923

Archey and Lindsay reported it as "abundant, both among the karaka groves of the northern sandhills, and in the denser bush of the southern plateau." Fifteen years later Fleming said that the islanders believe that the pigeon is decreasing and is bound to decrease in numbers. Fleming noted the following berries as being eaten by this pigeon: karaka (kopi), supplejack, suttonia and corokia (whakataka), also the young shoots of shrubs. To these may be added tutu berries.

Nesting. A nest was found by Fleming and Turbott on November 29th in coastal scrub on Wharekauri. It was about twenty-five feet from the ground in a kopi tree, "a flimsy structure of small sticks, not sufficiently dense to prevent the sky being seen through it from below."

References.—Rothschild, Proc. Zool. Soc., 1891, p. 312, col. pl. (*Carpophaga chathamensis,* Chatham Islands). Forbes, Ibis, 1893, p. 527. Buller, Suppl. Birds N.Z., 1, 41, 1905. Fleming, Emu, 38, 500, 1939. Mathews, Suppl. Birds Lord Howe Norf., 76, col. pl., 1936.

ORDER PASSERIFORMES

PERCHING BIRDS

Bill straight or curved, never hooked. Primaries 9 or 10; wing coverts short, not more than half length of secondaries. Tail usually of 12 feathers. Tarsi usually long and weak; three toes in front, one behind; hind toe long. In the skull the vomer is truncate in front.

This Order contains all the small perching birds, numbering more than six thousand species. It is divided into two sections, the Mesomyodi, or songless Passeriformes, and the Acromyodi or singing Passeriformes. In the Mesomyodi the intrinsic muscles of the syrinx are simple and inserted into the middle of the bronchial semi-rings. This section includes the New Zealand family Acanthisittidae. In the Acromyodi, or singing Passeriformes, the muscles are complex and attached to the ends of the bronchial semi-rings. The remainder of our Passeriformes belong to this section.

The classification of the Passeriformes into Families can hardly be said to be in a satisfactory state at any rate as far as the Families Sylviidae and Muscicapidae and the various Australian and New Zealand species referred to these families are concerned. I do not think the classification of this great group will be placed on a sound basis until the palate is described in representatives of every genus. I have associated *Petroica* and *Gerygone* in one family, using the name Muscisapidae for it, because they both possess long maxillo-palatines scarcely expanded at the tip. Similarly I have placed *Mohoua, Finschia* and *Bowdleria* in another family because of the pedunculate maxillo-palatines and for this I have used the name Sylviidae. But this disposition is only tentative because I have not examined the palates of *Muscicapa* and *Sylvia.* Furthermore I have founded a family, Rhipiduradae, for *Rhipidura* because the maxillo-palatines are totally different from those in all the other New Zealand genera of Passeriformes that I have studied.

For illustrations of the palates of New Zealand birds see my paper in *The Emu*, vol. 45, pp. 55, 119, 1945. There is an important paper on the classification of the Passeriformes by Beecher in *The Auk,* vol. 70, p. 270, 1953.

The following key is mainly artificial.

Key to New Zealand Families

Bill very wide at gape. Wings very long. Primaries ten	*Apodidae*
Bill not wide, except Rhipiduridae. Wings moderate. Primaries 9-10.	
Tail very short, scarcely projecting beyond wings	*Acanthisittidae*
Tail moderate or long.	
Primaries nine, first long.	
Bill broad at base	*Hirundinidae*
Bill narrow at base.	
Upper surface brown	*Motacillidae*
Upper surface mostly green	*Zosteropidae*
Primaries ten, first short.	
Without wattles at gape.	
Upper mandible with distinct notch near tip.	
Bill broader than high	*Campophagidae*
Bill higher than broad	*Turnagridae*

Upper mandible without distinct notch near tip.
Bristles at base of bill.
Tarsi booted .... *Muscicapidae*
Tarsi scutellate.
Small birds, weak bills .... *Rhipiduridae*
Large birds, strong bills .... *Corvidae*
Without bristles at base of bill (except *Notiomystis*).
Tail graduated, rectrices ten .... *Sylviidae*
Tail emarginate, rectrices twelve .... *Meliphagidae*
Wattles at gape.
(Tail graduated .... *Anthochaera*)
Tail rounded.
Bill long, sharp-pointed .... *Philesturnidae*
Bill short, obtusely pointed .... *Callaeadidae*

FAMILY APODIDAE. SWIFTS

Bill short, curved, very wide at gape. Wings very long and pointed, 10 primaries. Tail feathers 10.

Key to New Zealand Genera

Tail feathers normal .... *Apus*
Tail feathers with spinous points to shafts .... *Chaetura*

Genus Apus

Bill short, depressed, curved. Second quill longest. Tail forked. Tarsi feathered, toes unfeathered; toes all diverted forwards, each with three phalanges.

About sixteen species found in most parts of the world. Summer migrant to Australia; accidental in New Zealand.

Reference.—Scopoli, Intro. Hist. Nat., 183, 1777 (*Apus,* type *Hirundo apus* L.).

Australian Swift

Apus pacificus

The Australian Swift has only twice been taken in New Zealand. In December, 1884, Major W. B. Messenger noticed four birds which reminded him of Swifts flying about his camp at White Cliffs, Taranaki. To make sure he shot one and it proved to be this species.

Adult. Upper surface blackish brown with greenish gloss, the feathers narrowly edged with paler; white band across rump, with brown shaft stripes. Chin and throat white with brown shaft stripes; remainder of under surface brown with whitish edges and blackish subterminal bars to the feathers. Bill black. Iris brown. Feet pinkish. Bill 7.5, wing 180, tail 76, tarsus 13, mid toe 14 mm.

Eggs. Clutch two or three, ovoid, white, 25.4 x 15.2, 26 x 16.7 mm. Eastern Asia.

Distribution. White Cliffs (Taranaki), Karamea. Lake Taupo, sight record.

Breeds in Siberia, China and Japan. Winters in New Guinea, Australia and Tasmania.

Habits. The Australian Swift lives entirely on insects which it catches on the wing. It was found nesting in the cliffs of the River Lena and also in buildings in Yakutsk by R. Hall, who describes the nests as composed of a few straws and feathers cemented by saliva. Nests found by Commodore Cochrane on the north-east coast of China were placed in the crevices of sea cliffs. They were composed of straw with a few feathers, knit together with a glutinous matter.

References.—Latham, Ind. Orn. Suppl., 58, 1801 (*Hirundo pacificus,* N.S.W.). Buller, Birds N.Z., 2nd ed., 1, 116, 1888. Hall. Emu. 8. 148. 1909. Cochrane, Emu, 19, 176 1920.

Genus Chaetura

Bill short, depressed, curved. Wings reaching far beyond end of tail. Tail square, shafts of feathers stiff with projecting spinous points. Tarsi unfeathered. Three phalanges on second toe, four on third, five on fourth.

About twenty species distributed over most parts of the world except Europe. Migrates to Australia; accidental in New Zealand.

Reference.—Stephens, Shaw's Gen. Zool., 13, 76, 1826 (*Chaetura,* type *Hirundo pelagica* L.).

Spine-tailed Swift

Chaetura caudacuta caudacuta

Since 1888 odd birds and small and large groups of Spine-tailed Swifts have been seen in New Zealand at intervals averaging about five years. The first record was based on a bird taken at Manaia in March, 1888, and the second at New Plymouth in 1915. In 1930 there were four occurrences in the Manawatu district in the vicinity of Tokomaru. There were small numbers in 1932, 1936 and 1940, and a large invasion from November, 1942, to February, 1943, over the whole country from Whangarei to Stewart Island. Since 1943 a few swifts have been seen, the last being at Hokio Beach in December, 1951. Almost all the visitations have been in the summer months. A few birds have been seen in August and September.

Adult. Forehead white; top and sides of head shining green tinged with brown; black space in front of eye; back, scapulars and rump brown; wings and tail shining green with purple reflections; white patch on upper tail coverts. Chin, throat and under tail coverts white; chest and abdomen clove-brown. Bill black. Feet brown. Bill 8.5, wing 200, tail 88, tarsus 16, mid toe 18 mm. Hokio Beach.

Distribution. The Spine-tailed Swift has been recorded from about thirty localities mainly in the western districts of Auckland, Taranaki, Wellington, Nelson and Westland, and from the eastern side of Canterbury. There are no records from the eastern districts of the North Island or from Marlborough or Otago. One record from Horse Shoe Bay, Stewart Island. Localities showing extent of area where Swifts have occurred: Whangarei, Whangaparoa, Te Awamutu, Lake Taupo, Mokau, Waitara, Mount Egmont, Hokio Beach, Paraparaumu, Stoke, Pakawau, Westport, Greymouth, Hokitika, New Brighton, Waimate, Lake Ellesmere. Straggler to Campbell Island.

Breeding in Eastern Siberia, Mongolia, Manchukuo and Japan. Migrating to South China, New Guinea, Australia and Tasmania.

Habits. The Spine-tailed Swift nests on the upper part of the Yenesei and in China and Japan, in June and July. Describing the breeding habits of this species in Japan, Le Souef states that the nests are made of mud of two or three colours, and are built on a sloping wall of rock well under cover. "These birds," continues Le Souef, "having such short legs and long wings cannot rise off the ground; they therefore roost on the face of a cliff or rough bark of a tree, but their home is the air." In Tasmania, the Spine-tailed Swift is present during February and March. It is generally seen before a storm. Numbers of them have been observed in a heavy rainstorm to hurl themselves against the stem of a tree and cling on to the trunk on the exposed side. "When the rain ceased they threw themselves into the air in much the same fashion as they had pitched, and went their way," writes Miss M. Anderson who witnessed this strange scene.

References.—Latham, Ind. Orn. Suppl., 57, 1801 (*Hirundo caudacuta*, N.S.W.). Le Souef, Emu, 7, 73, 1907. McCaskill, N.Z. Bird Notes, 1, 38, 1943.

FAMILY ACANTHISITTIDAE
NEW ZEALAND WRENS

Bill straight, not notched, no mouth bristles. Wings rounded, secondaries nearly as long as primaries. Tail very short, of 10 feathers. Tarsi booted (or scutellae faintly marked).

New Zealand only.

Key to Genera

Bill much shorter than tarsus.
  Quills firm.
    Bill slender. Under surface white .... *Acanthisitta*
    Bill stouter. Under surface not white .... *Xenicus*
Bill nearly as long as tarsus.
  Quills soft .... *Traversia*

GENUS ACANTHISITTA

Bill slender, straight, gonys ascending. Third to fifth quills longest. Tarsi very slender, booted, about twice as long as culmen.

Allied to Xenicus but smaller and with more slender bill and tarsi.

Key to Subspecies

Size smaller. Yellow areas pale or greenish.
- Rump greenish yellow .... *A. ch. granti*
- Rump yellow .... *A. ch. chloris*

Size larger. Yellow areas bright *A. ch. citrina*

The differences between these forms is slight and it is doubtful whether, when a good series of each can be compared, subspecific rank will be confirmed for them.

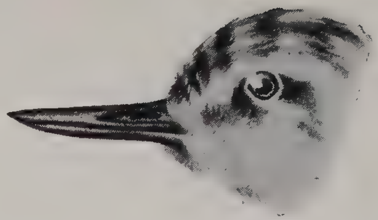
References.—Lafresnaye, Mag. Zool. 1842, p. 27 (*Acanthisitta,* type *Sitta chloris* Sparrm.) Oliver, Emu, 45, 142, 1945 (vomer.).

North Island Rifleman
Acanthisitta chloris granti

The North Island Rifleman is evidently the piripiri of Yate describing the birds of the Bay of Islands in 1835, although the information he gives about them is not altogether correct. It was collected at Port Nicholson about 1840 by P. Earl.

Adult. The plumages of the male and female are the same as those of the South Island Rifleman but the rump is greenish yellow, and the yellow coloration on the sides, flanks and under tail coverts is if anything a little paler than in the southern subspecies. Bill black, inside mouth yellow with orange at gape. Iris black. Feet brownish black, posterior side of tarsus and soles gamboge, claws black. Bill 9.5-12, wing 47-49, tail 21-24, tarsus 18-19, mid toe 15 mm. *Male immature.* Top of head striped olive and dark brown; hind neck yellow; remainder as in adult. *Female immature* similar to adult.

Distribution. North Island from Bay of Islands, Hen Island, and the Barrier Islands southwards, now not found north of Mount Egmont, the Bay of Plenty and the East Cape district, except on Great and Little Barrier Islands. Minginui, Waikaremoana, Mount Hikurangi, Mamaku, Huiarau Range, Tauhara, Ruahine and Tararua Ranges to Cook Strait. Probably in all large areas of forest.



After Lily A. Daff
RIFLEMAN

Habitat. The North Island Rifleman appears to be most abundant in beech forests although it inhabits rimu and other kinds of forest. On the Tararua Range they are to be seen climbing up the trunks of trees, among shrubs and on the ground. They hop along in a jerky fashion, fluttering their wings at each hop, and occasionally taking short flights. At Maungahaumia in the Gisborne district M'Lean said, in 1907, that the Rifleman was common in the tawa and mixed bush and still more so in the beech, but was never noticed in the tawhera. "In April," writes M'Lean, "it was usually seen in couples, but often a party of four or five individuals was noticed—evidently late broods. After that it was invariably found in pairs. Each pair seems to have its own beat and to traverse it daily with great regularity, never wandering far from its home, and even when the bush went down the birds remained in the felled timber about these spots."

The Rifleman sometimes comes out into the cleared country. On this point Stidolph has written as follows: "It is very much at home in beech bush, although it also favours other types of country at times even being found in the more extensive hedgerows of the Taranaki district, in the gorse and broom wastes of hills near Wellington, in precipitous gorges in the midst of farming districts, and occasionally in certain localities in a town park, as at Stratford."

Food. So far as is known the food of the

North Island Rifleman consists of insects and their larvae, spiders and opiliones. The bird usually starts on the trunk of a tree near the ground and climbs to a height of twenty or thirty feet in short hops and with fluttering wings, diligently searching in the crannies in the bark and among the moss and lichen growing there. It then drops with open wings to the bole of another tree and starts again usually climbing in a spiral course.

Nesting. The North Island Rifleman chooses for its nesting site some well hidden and protected place in which its covered nest will fit closely. Near Mangaweka a nest was found by Stidolph in an overblown cabbage tree. The nest was built of fine roots and leaves lined with feathers, mostly those of the goldfinch. The entrance was so small that it was barely possible to admit a finger. Another nest found by Stidolph near Inglewood was in a hole in the trunk of a mahoe about seven feet from the ground and was built of fine fibres and fur. In the same locality a nest was found in a hole in a ngaio trunk. A fourth nest was found in a bank in a hole left by a decayed root. "It was so carefully hidden that only the outside of it could be seen by peering into the small hole giving access to it." It will be seen that the Rifleman uses the material that is at hand and so feathers of an introduced bird and fur from an introduced mammal have been requisitioned.

A nest found at Maungahaumia by M'Lean was placed in a network of roots with the base resting on damp mould. It was not discernible from the outside. The nest was described as a compact oval ball measuring about five inches each way. It was composed of very fine rootlets much interwoven with a little moss, a few leaf skeletons and one or two thin pieces of dry ribbon-like bark. The interior was lined with fern scales and fine moss well felted together. One end was slightly flattened and composed of very tightly interwoven rootlets through which the entrance, .85 inch in diameter, tunnelled for 1.8 inches to the circular egg chamber which was about two and a half inches in diameter. The entrance opened towards the top of the egg chamber.

The Rifleman commences to breed in August and nests with young have been found in November, indicating that two broods are reared in a season. A pair of Riflemen watched by L. F. P. Taylor on the east side of Wellington Habour reared two sittings of eggs in a season, with an interval of three to four weeks between them.

References.—Mathews and Iredale, Ibis, 1913, p. 432 (*Acanthisitta chloris granti,* North Island). M'Lean, Ibis, 1907, p. 536.

South Island Rifleman. Titi-pounamu
Acanthisitta chloris chloris

The South Island Rifleman was discovered in 1773, probably at Queen Charlotte Sound, during Cook's second voyage, and was described by Sparrman, who joined the expedition at the Cape of Good Hope. It was next met with at Tasman Bay by Quoy and Gaimard, naturalists to the French Expedition which, in 1827, visited New Zealand in the *Astrolabe.* Sparrman left an illustration of his specimen and this agrees with the common South Island Rifleman.

Adult Male. Forehead tinged with reddish. Upper surface green, rump yellow; tail black, tipped with fuscous; wing coverts black; quills green on the outer webs, brown

Lake Ohau *K. V. Bigwood*

SOUTH ISLAND RIFLEMAN, MALE

Lake Ohau *K. V. Bigwood*
SOUTH ISLAND RIFLEMAN, FEMALE

on the inner with a yellow band below the coverts; a white spot on outer web of inner secondary. Superciliary streak fulvous white; under surface fulvous white, yellow on the flanks. Bill, iris and feet as in *A. c. granti.* Bill 10-11, wing 47-51, tail 20-27, tarsus 18, mid toe 15-18 mm. *Adult Female.* Top of head, hind neck, upper back and smaller wing coverts olivaceous yellow streaked with dark brown; lower back and rump olivaceous yellow; tail black, tipped with fulvous; greater wing coverts black; quills olivaceous yellow on outer webs, brown on inner with a yellow band below the coverts; a white spot on outer webs of inner secondary. Superciliary streak and lower surface buffy white, yellow on the flanks. *Immature.* Similar to adult female; crown to back pale brown streaked with blackish; rump and outer margin of quills tinged with olive; chin, throat and breast spotted with brown.

Eggs. Clutch four, sometimes five, ovoid, white, 16 x 13 mm. Te Anau. 16 x 12.5, 16.2 x 12.2 mm. Lake Hawea.

Distribution. South Island; common throughout in forests from Mount Arthur to Fiordland. Western Canterbury and Banks Peninsula. Dunedin, 1951. Stewart Island, Codfish Island.

Habitat. The Rifleman is essentially a bird of the forest interior. It is especially characteristic of beech forests, but occurs in rimu and tawa forests as well. It is quite common at high elevations as well as at sea level. In Stewart Island Guthrie-Smith found the Rifleman in March fairly common on forest spurs at a considerable height. In October it was no longer chiefly on the high lands and nests were found at sea level. It is evident from this that the Rifleman breeds on the lower levels and after the nesting season moves to higher ground.

Food. The food of the Rifleman consists so far as is known of insects and spiders. Its whole daylight hours seem to be spent climbing up and down the trunks and branches of trees diligently searching the bark, mosses and lichens for their insect inhabitants. It also feeds on the ground, turning over leaves in seach of insects. Riflemen have been reported as mingling with flocks of white-eyes presumably because the white-eyes disturb insects.

Voice. Its very small high-pitched note is often heard and reminds one of the sound made by striking together two pieces of wire. Andersen says that the notes might be vocalized *titit* or *tutut,* in combinations of two, three, or more notes. "A wren sounded this *tutut* while ascending a vine in its quick, jerky fashion; it was *tutut* and a jerk upwards, *tutut* and another jerk, as though the bird had to wind itself up for each movement, and one heard the snapping of

Lake Ohau *K. V. Bigwood*
SOUTH ISLAND RIFLEMAN

the tiny pawls of its lilliputian winding gear."

Nesting. The Rifleman's nest is generally placed near the ground. Usually a hole or crevice in a tree or log is chosen and the entrance may be so small as to be found only with difficulty. The breeding season commences in August and nests with young have been found in January, so evidently two broods are reared in a season. Both parents feed the young. Potts who resided in Canterbury gives the following description of the nesting habits of the Rifleman. "Often builds in a small hole of a tree. The nest may be found in an open wood near the top of a range, or in the sheltered gully. In my notes of the breeding habits of New Zealand birds there was figured a nest built in a roll of bark that hung and swung in some convolvulus. On the 14th September I saw three pairs building. The nest is a peculiar structure, made of very fine sprays, rootlets, fern fibres, grasses, dead and skeleton leaves, and a few feathers. The small entrance leads to an oblong or pear-shaped nest, which is all covered in except the opening. Some specimens of the nests measure six inches in length, with a breadth, from the curled fern-rootlets that bind round, and serve to strengthen the entrance, of four inches."

References.—Sparrman, Mus. Carls., 2, No. 33, 1787 (*Sitta chloris,* probably Queen Charlotte Sound). Quoy and Gaimard, Voy. Astrol. Zool., 1, 221, col. pl. 1830 (*S. punctata*). Buller, Birds N.Z., 112, 1872; 2nd ed., 1, 113, col. pl. 1888. Grant, Ibis, 1905, 595. Potts, N.Z. Jour. Sci., 2, 282, 1884. Pycraft, Ibis, 1905, 603 (anatomy). Guthrie-Smith Mutton Birds, 123, 1914. Andersen, Bird Song, 162, 1926.

Alpine Rifleman

Acanthisitta chloris citrina

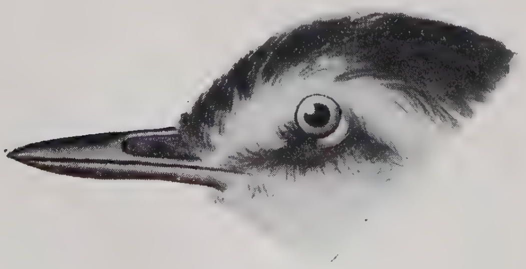
A Rifleman collected by Forster at Dusky Sound in 1773 during Cook's second voyage was described by Latham as the Citrine Warbler. Gmelin converted this name to its scientific form *Motacilla citrina.* It was, for a rifleman, large and had much yellow about the rump and flanks. Other riflemen of comparatively large size have been recorded from as far north as north-west Nelson but there do not now appear to be any of these specimens in existence. However, in 1901, a specimen was collected in Dusky Sound during a visit of Lord Ranfurly to that locality. This was identified by Ogilvie-Grant as belonging to Gmelin's species. Then, in 1953, T. Riney of the Internal Affairs Department brought back from the Reischek Range, south of Dusky Sound, a third specimen, a female, appreciably larger than the common form and with conspicuous regions of bright yellow. On receipt of this at the Dominion Museum I applied to the British Museum for a report on the specimens from Dusky Sound in that institution and received a reply from Mr. R. W. Sims stating that Forster's specimen as figured in his drawing belonged to a species distinct from and larger than the common rifleman. He also stated that Ogilvie-Grant was correct in his determination of Ranfurly's bird as *citrina.* Mathews and Iredale had published their opinion that the descriptions of Gmelin's *citrina* and Sparrman's *chloris* referred to the same bird but Mr. Sims considers this view unwarrantable as the two drawings and their descriptions tally with the two species known by specimens. As Forster's specimen comes from Dusky Sound it is probable that Sparrman's came from Queen Charlotte Sound where the common rifleman is abundant. I have therefore adopted Mr. Sims' views as to the identification of the Dusky Sound form with *citrina* but treat it as of subspecific rank only.

Adult Male. "Recognised by the wide and strongly defined white eye-brow stripe and by having the mantle and back of a bright sap-green colour, the rump and upper tail-coverts yellow, faintly tinged with greenish, but contrasting strongly with the back; and the sides, flanks, and under tail coverts bright yellow. Iris and bill black, legs brown, feet bright yellow. Size larger than in *A. chloris.*" (Ogilvie-Grant.) Wing 53.3, tarsus 20.6 mm. (from Grant's mmts.) *Adult Female.* Crown, hindneck, back and lesser wing coverts striped black and olive; eye stripe white; lores and forehead yellowish white; rump greenish yellow; tail black with yellow tip; edge of wing beyond carpel flexure white; greater coverts black; quills dark brown, the outer edge olive green and the bases yellow. Under surface white, the throat tinged with pink; flanks and under tail coverts bright yellow. Bill dark brown. Feet brown, the soles orange. Bill 13, wing 55, tail 23, tarsus 22, mid toe 19 mm. Reischek Range.

Status. The large size and yellow rump, flanks and under tail coverts distinguish this subspecies from the other two. The status of the subspecies is uncertain as some specimens from Bourke Hut and the Makaroro district, while agreeing in size of bill, wings and feet, and in the bright yellow flanks differ in the less conspicuous black striping on the upper surface of the female; also birds with stout hind toes or with weak hind toes occur in the same series.

Distribution. Dusky Sound (Forster, Ranfurly). Reischek Range, south of Dusky Sound (Riney). Probably riflemen recorded from Caswell, Doubtful and Chalky Sounds belong to this subspecies. Also recorded from mountains of Nelson (Buller). Specimens from Bourke Hut and Makaroro agree in size and yellow colouring.

Habits. Buller states that Mr. Brough, who collected the specimens from the Nelson Mountains, wrote: "I am sending you some specimens of the Alpine or Snow Rifleman. It is much larger than the species inhabiting the lowlands. I met with it generally at an altitude of 4,000 feet, on the outskirts of the forest growth. They generally move about in pairs, and are not unlike the Bush Wren in their habits. They seem to be paired all the winter. I am quite certain that this bird is distinct from *A. chloris.*"



After Lily A. Daff
BUSH WREN

References.—Gmelin Syst. Nat., 979, 1788 (*Motacilla citrina,* Dusky Bay). Ogilvie-Grant, Ibis, 1905, p. 595 (*A. citrina*). Buller, Suppl. Birds N.Z., 2, 103, 1905 (*A. citrina*).

GENUS XENICUS

Bill rather strong, culmen slightly curved. Third to fifth quills longest. Tarsi booted, about twice length of culmen, rather strong.

Xenicus is a close ally of Acanthisitta, differing mainly in its stouter bill and feet.

Key to Species

Hind toe long; fulvous spots on secondaries .... *X. gilviventris*
Hind toe shorter; no spots on secondaries .... *X. longipes*

Reference.—Gray, Gen. Birds, 31, 1855 (*Xenicus,* type *Motacilla longipes* Gmel.).

North Island Bush Wren
Xenicus longipes stokesi

About 1850 two specimens of a Bush Wren were collected in the Rimutaka Range, either by Lyall or Strange, and were forwarded to the British Museum by Captain Stokes of the surveying ship *Acheron.* One was an adult bird and was mistakenly identified as the South Island Bush Wren. The other was a juvenal and was made the type of a new species, *Xenicus stokesi.* No further specimens of the North Island Bush Wren have since been taken though there are a few reports of its having been seen.

Adult. Similar to *X. l. longipes* but distinguished by the "shining slate blue sides of the neck and chest tinged, in certain lights, with greenish, and the patch of pure yellow feathers on the yellowish green flanks." (Grant.) Wing 53.3 mm. *Immature.* "Purplish brown above, tinged with olive on the lower part of the back; quills dull purplish brown with the outer margins olivaceous; beneath purplish white shining in some lights; the sides and abdomen olivaceous; a broad white streak extending from the nostrils over each eye to the hind part of the head; bill black; legs and toes pale yellow." (Gray.) Bill 16, wing 57, tarsus 26, mid toe 20 mm.

Status. The differences between this North Island subspecies and the South Island one are rather slight and further specimens are required to confirm their constancy, but on account of the isolation of these weak flying birds it is likely that they would exhibit differentiating characters.

Distribution. Rimutaka Range. Sight records from Huiarau Range, Lake Waikareiti, Mount Egmont, Upper Waitotara Valley and Makuri Gorge. All doubtful.

References.—Gray, Ibis, 1862, p. 219 (*Xenicus stokesii,* Rimutaka Hills). Grant, Ibis, 1905, p. 593, col. pl.

South Island Bush Wren. Matuhi
Xenicus longipes longipes

It was while Cook was refitting his ships at Dusky Sound during his second voyage that Forster discovered the Bush Wren in the adjacent forest. His painting, which was later reproduced in the report of the *Erebus* and *Terror,* formed the basis of Latham's "Long-legged Warbler," a term used by Gmelin when founding the specific name.

Adult. Top of head, hind neck and sides of face dark purplish brown; remainder of upper surface dark green, tinged with yellow; a lemon-yellow patch on the edge of the wing near the flexure, bordered behind with a deep brown patch; outer webs of quills olivaceous green, inner webs brown; tail olivaceous green. Superciliary streak and chin white; breast and abdomen grey; sides and under tail coverts yellowish green. Bill and iris brownish black. Feet pale brown. Bill 11-13, wing 54-55, tail 24-26, tarsus 25-26, mid toe 23 mm. *Immature.* Upper surface purplish brown, darkest on the head; lower back, wing coverts (except primary) and outer webs of quills olive-brown; primary coverts deep brown; a lemon-yellow patch near flexure of wing; tail olivaceous green; a conspicuous white superciliary streak. Under surface purplish grey; under wing coverts lemon yellow; flanks and under tail coverts yellowish olive.

Eggs. Clutch two, ovoid, white, 18 x 14 mm. Fulton's Bush. 17 x 13.5, 18.7 x 12.2 mm. Otago.

Status. X. longipes is distinguished from *X. gilviventris* by its greener upper surface, slaty instead of brown under surface, absence of buff spots on the secondaries, and shorter hind claw. *X. l. longipes* differs from *X. l. stokesi* in the sides of the neck being less bluish and the lesser amount of yellow feathers on the sides. From *X. l. variabilis* it differs by being more green on the upper surface and whiter on the superciliary streak and chin.

Distribution. South Island from Mount Arthur (no recent records), Tasman and Spencer Ranges throughout the mountainous regions on both sides of the main divide and reaching the coast in Fiordland. Milford, Caswell, Chalky and Dusky Sounds and the Upper Hollyford Valley.

Habitat. The South Island Bush Wren is found sparingly in the damp beech and rimu forests of the Southern Alps usually at a considerable altitude and up to the upper limits of the forest. In the Fiordland area it comes down to near sea level. At the Homer in the Upper Hollyford Valley where the forest is silver beech it is not infrequently seen in parties of two or four among the branches of trees and flying from one to another thus differing in habits from the Rifleman which is more often seen on the trunks of trees. It feeds on the ground as well as on the trees and then its peculiar habit of bobbing its head may be observed Formerly it was reported as common in mountain forests but it is now absent or rare in many parts of its range having, according to several observers, been exterminated or partially so by cats, rats and stoats.

Food. Potts watched the Bush Wren in the upper reaches of the Raka'a Valley busily searching for insects among the mosses and lichens on the forest floor and in the forest undergrowth. At the Homer it frequented the Public Works Department's camps picking up scraps of food thrown out of the huts.

Nesting. Very few nests of the Bush Wren have been found. One was discovered by Potts about 1870 in a mixed forest of totara, ribbonwood (*Hoheria glabrata*) and beech, at the headwaters of the Havelock River, a tributary of the Rakaia. Potts' description is as follows: "Late in the month of December I found the nest far up the Havelock River; it was beneath the moss-covered roots of an alpine ribbonwood tree; it looked like a thick tuft of moss. Beneath this protective covering the pouch-shaped nest was built, with the opening near the top; it was almost entirely composed of fern rootlets, the entrance being neatly and strongly formed with extra entwinements of the same material; the inside was lined with feathers somewhat profusely. The entrance was so well hidden as to be scarcely discernible; it was so difficult to discover that I scarcely remember any nest that afforded me more pleasure in finding. It was ready for use, but contained no eggs."

References.—Gmelin, Syst. Nat., 979, 1789 (*Motacilla longipes,* Dusky Sound). Gray, Zool. Erebus and Terror, Birds, 4, col. pl. 1845. Potts, Trans. N.Z. Inst., 5, 176, 1873; N.Z. Jour. Sci., 2, 281, 1884. Buller, Birds N.Z., 115, col. pl. 1872; 2nd ed., 1, 108, col. pl. 1888; Suppl. 2, 104, 1905. Grant, Ibis, 1905, p. 592, col. pl.

Stewart Island Bush Wren

Xenicus longipes variabilis

Lying off the south-west coast of Stewart Island are a number of islets which, thanks to their isolation in a stormy region, have, as Guthrie-Smith says, "an avifauna and flora not affected by the changes that have elsewhere transformed New Zealand into a second England." In 1913 Guthrie-Smith visited two of these islets, Big South Cape Island and Solomon Island. On both he found a Bush Wren which he did not distinguish from the Bush Wren of the South Island. This was in fact the first discovery of this subspecies by an ornithologist. Later Stead visited some of these islands, including Solomon Island, and on specimens he collected there described the wren as a distinct subspecies, *variabilis.*

Adult. "Upper surface brownish green, greener on the rump; head and neck brown, superciliary streak from bill to nape grey white; a dark spot in front of the eye; ear coverts brown, slightly larger than the crown; wing coverts greenish brown; primaries light brown, outer webs green. Chin light grey; breast and abdomen slate grey tinged with brown; sides of body green slightly lighter than back; under tail coverts light green. Wing 52-56, tarsus 24-25 mm. In some birds the whole of the upper surface is brown faintly tinged with green at most, and the white superciliary streak is absent. All gradations between this and the greenest form are to be met with, the variation being independent of sex or age, the birds of various colours pairing independently." (Stead.) A male specimen from Big South Cape Island is similar but has conspicuous yellowish white marginal coverts. Bill 11.5, wing 52, tail 26, tarsus 25, mid toe 21 mm.

Eggs. White, 21 x 15.4, 21 x 15.5 mm. Solomon Island.

Status. X. l. variabilis is slightly smaller than *X. l. longipes* though its egg is larger; back much less suffused with green; brown of the head runs further down the neck; superciliary streak less distinct and chin not so white. In some cases the brown of the head extends down the back including the scapulars and upper wing coverts. (Stead.)

Distribution. Islands off south-west coast of Stewart Island: South Cape, Big South Cape, Solomon. Stead says that this subspecies of Bush Wren is fairly abundant on three islands to the south-west of Stewart Island and possibly on two others. Presumably the wren that was formerly present on Stewart Island belonged to this subspecies. A bush wren was recently reported as being seen on Mount Rakiahua (I. Tily).

Voice. According to Guthrie-Smith the conversational note of the birds among the low vegetation where their lives are passed is a faint rasping sound; when alarmed or excited they utter a loud cheep.

Nesting. Stead says that the Bush Wren on Solomon Island is largely terrestrial and often nests in holes in the ground, though sometimes in prostrate logs or in clumps of fern. Eggs were found in mid-December.

The breeding habits of the Bush Wren have been closely studied on Solomon Island by Guthrie-Smith. Three nests were kept under observation for some weeks. The entrance to one was half way down the side of a rata log covered with the creeping Polypodium. Another was down a petrel's burrow, the passage to the wren's nest passing upwards into the roots of a fern clump. The third nest was in the centre of a half dead tupari (*Olearia colensoi*). All the nests were found to be damp and after each shower the birds were seen carrying in dry feathers and taking out wet ones. The nests are more or less spherical structures composed of fern leaves and rootlets lined with feathers. Both parents shared the work of incubation and fed the chicks on moths, flies and daddy-long-legs. Eggs were found in November.

References.—Guthrie-Smith, Bird Life, 141, 1925. Stead, Trans. Roy. Soc. N.Z., 66, 313, 1936 (*X. l. variabilis,* Solomon Island).

Rock Wren

Xenicus gilviventris gilviventris

This subspecies was discovered about 1866 in the alpine regions of the South Island by Dr. Haast who forwarded specimens to both von Pelzeln and Buller. Each described it as a new species, von Pelzeln's account appearing first. Its nest was first discovered by Mr. Brough about 1880 among loose rocks on a mountain in the Nelson district.

Adult. Forehead and crown olive brown; remainder of upper surface olive brown tinged with yellowish green, the rump more greenish; a dark brown patch on the outer margin of the wing; quills olive on their outer webs, brown on the inner; fulvous spots on outer webs of secondaries; tail dull olive. Superciliary streak and chin fulvous white; under surface brownish ashy; sides yellowish. Bill and iris blackish brown. Feet pale brown. Bill 10-11.5, wing 50-53.2, tail 20, tarsus, 23-28.5, mid toe 23, hind toe 20-24 mm. *Immature.* Forehead to nape purplish brown; superciliary streak white; remainder of upper surface brown tinged with yellowish green, the rump and tail more green; dark brown mark on wing coverts and buff spots on secondaries. Chin to upper part of abdomen vinous brown; sides of body and lower part of abdomen dull lemon yellow.

Eggs. Clutch five, ovoid, white, 20.5 x 15, 19.4 x 15.4 mm. Te Anau.

Distribution. South Island, along the central and western mountain chain but now rare in Nelson, 3,000-8,000 feet. Recently reported from the Inland Kaikoura Range and from Mount Rakeahua, Stewart Island.

Habitat. Above the forest line on the mountains of the South Island is first a belt of low scrub and then open rocky ground more or less clothed with tussock grass and herbs. It is the rocky talus slopes with their numerous crevices that are specially favoured by the Rock Wren. In the Homer cirque from 3,000 to 4,000 feet the Rock Wren is found among the large angular blocks that make up the talus slopes below the precipitous sides of the valley. It emerges from the crevices and flits about for short distances but disappears if one attempts to approach too near. On Mount Moltke, at an altitude of about 5,000 feet, Miss H. Laing drew my attention to a Rock Wren coming towards us but when a kea settled further away the wren turned and flew towards the kea. Buchanan states that he saw Rock Wrens on Black Peak at an altitude of 8,000 feet. The Rock Wren, like its congener the Bush Wren, constantly bobs its head when settled. Guthrie-Smith said that the powers of flight of the Rock Wren were greatly superior to those of the Bush Wren. Perhaps this has some relation to the exposed habitat in which the Rock Wren lives.

Food. Its food consists of insects and spiders which it seeks on the ground and also, as Guthrie-Smith has observed, by alighting upon and exploring the tops of shrubby Veronicas.

Nesting. The nest of the Rock Wren is, according to its first discoverer Mr. Brough, placed in a sheltered crevice among the loose rocks or debris of the mountain. It is of a rounded form with the entrance, about an inch across, on one side, and is composed of rootlets, twigs and leaves lined with feathers. There were five eggs in the nest on September 24th. A nest containing chicks was found by Guthrie-Smith on Mackinnon Pass in late November. "The orifice of the nest pierced into a fibrous mass of overhanging roots." It was a bulky nest composed of skeleton leaves, fine grasses and feathers. Nearly 800 feathers were used in the nest, mostly weka, but kakapo, kiwi, kea and pigeons' feathers were also included. From Brough's and Guthrie-Smith's findings it may be concluded that the laying time of the Rock Wren is September and October.

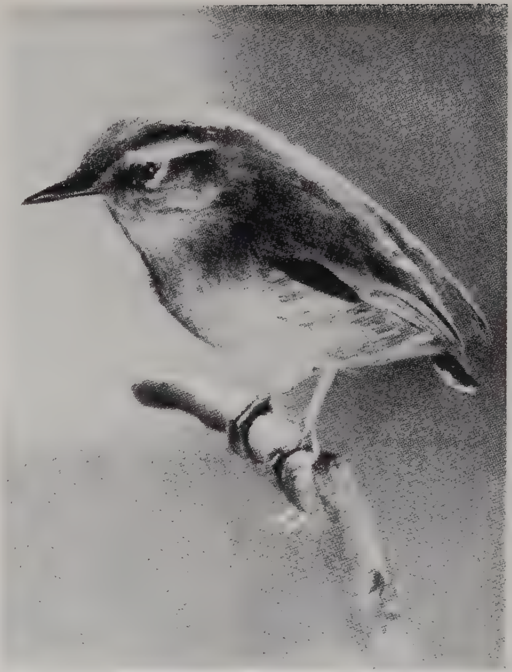
References.—Pelzeln, Verh. Zool. Bot. Gesell. Wien., 1867, p. 316 (*X. gilviventris*). Buller, Ibis, 1869, p. 37 (*X. haasti,* Canterbury Alps); Birds N.Z., 117, col. pl. 1872; 2nd ed., 1, 111, col. pl. 1888. Guthrie-Smith, N.Z. Jour. Sci. Tech, 7, 303, 1925

Fiordland Rock Wren

Xenicus gilviventris rineyi

An unusually green form of Rock Wren was seen in the Dusky Sound region in 1947 by J. A. McConochie and in 1951 by T. Riney but it was not until April 1953 that specimens were obtained by Riney from the Reischek Range between Dusky Sound and Chalky Inlet.

Adult. Upper parts bright olive green, tinged olive brown on forehead and crown; a pale cream stripe above the eye, more yellowish posteriorly, is bordered above by a blackish stripe; lores and line below eye blackish; black patch on outer margin of wing (false wing); inner secondaries with an apical spot of dull olive yellow on outer webs. Throat whitish; under wing coverts, axillaries and flanks yellow, shading to fawn on breast and abdomen. Bill black; iris brown; feet pinkish, toes olive. Bill 11-12, wing 47.5-49.5, tail 22, tarsus 24-26, mid toe 22, hind toe 18-21 mm.



FIORDLAND ROCK WREN

Status. Differs from *X. g. gilviventris* in the green of the upper surface being brighter and extending further down the sides of the neck and upper breast, and in the strong suffusion of yellow on the under surface. Size, except bill, smaller.

Distribution. Reischek Range, south of Dusky Sound. It is possible that the Rock Wrens previously collected in Dusky Sound and Preservation Inlet and seen in other parts of the Fiordland area belong to this subspecies. It has been recorded by Riney from Lake MacArthur, Fanny Bay (Dusky Sound) and Lake Roe.

Habits. Riney reports that this wren belongs to the scrub belt, that is, above the forest line, and though not seen in large numbers it was seen throughout this habitat. It rarely moved into the tussock country above the scrub. The wing spread is very small, about five and a half inches. The birds flew hardly at all, in fact they could not fly a distance of forty feet. When trying to fly they made an initial spring of about three or four feet. Their voice is a short nasal "peep" note made as they move through the scrub. The birds were curious and bold and came within five or six yards.

Reference.—Falla, Notornis, 5, 142, 1953 (*X. g. rineyi,* Lake McArthur. Riney, Notornis, 5, 186, 1953.

GENUS TRAVERSIA

Bill stout, nearly as long as tarsus. Wings short, rounded, plumage soft. Tarsus strong, booted. Hind toe nearly as long as tarsus.

A very distinct genus differing in nearly every character from Acanthisitta and Xenicus. Formerly confined to Stephen Island, the only species is now extinct.

Reference.—Rothschild, Bull. Br. Orn. Club, 4, 10, 1894 (*Traversia,* type *T. lyalli* Roths.).

Stephen Island Wren
Traversia lyalli

The history of this species, so far as human contact is concerned, begins and ends with the exploits of a domestic cat. In 1894 the lightkeeper's cat brought in eleven specimens, which came into the hands of H. H. Travers. Ten were forwarded to Rothschild and one to Buller and each recipient described the species under a different name. A few more captures were made and duly reported by the cat and then no more birds were brought in. It is evident, therefore, that the cat which discovered the species also immediately exterminated it.

Adult. Upper surface dark olive with brown margins to the feathers, giving a mottled appearance; wings at flexure olivaceous yellow; quills and tail olivaceous brown. Narrow superciliary streak, throat, foreneck and breast olivaceous yellow with dark margins to the feathers; abdomen and sides of body olivaceous brown. Bill dark brown, paler on lower mandible. Feet pale brown. Bill 14, wing 46-49, tail 17, tarsus 19-20, mid toe 20-21 mm.

Distribution. Stephen Island; extinct.

Habits. The only information concerning the habits of this species that has been recorded is that it was semi-nocturnal and lived among rocks, running about and hiding, but it was never seen to fly.

References.—Rothschild, Bull. Br. Orn. Club., 4, 10, 1894 (*Traversia lyalli,* Stephen Is.). Buller, Ibis, 1895, p. 236, col. pl. (*Xenicus insularis,* Stephen Is.); Suppl. Birds N.Z., 2, 109, col. pl. 1905; Trans. N.Z. Inst., 28, 340, 1896.

FAMILY HIRUNDINIDAE. SWALLOWS

Bill short, depressed, wide at gape. Wings long, primaries nine, first long. Tail feathers 12. Feet small.

The only members of this family that can be included in the New Zealand avifauna are occasional visitors from Australia.

Key to New Zealand Genera

Tail square or slightly emarginate.
Tarsi feathered .... *Hylochelidon*
Tail deeply forked. Tarsi bare .... *Hirundo*

GENUS HYLOCHELIDON

Bill with nostrils rounded and exposed. First quill longest. Tail square or slightly emarginate. Tarsi feathered, toes bare.

Reference.—Gould, Handb. Birds Austr., 1, 110, 1865 (*Hylochelidon,* type *Hirundo nigricans* Vieill.).

Australian Tree Martin
Hylochelidon nigricans nigricans

Small parties of the Australian Tree Martin have on several occasions been noticed in New Zealand. The first occurrence on record is that of 1851 when F. Jollie observed a flock at Wakapuaka and procured a specimen. The next visitation occurred in 1856 when Mr. Lee saw a Tree Martin at Cape Farewell. Since then the species has been noticed in various parts of New Zealand between Hicks Bay and Oamaru. At Oamaru it was reported in 1893 that a pair nested in a mill and reared some young ones.

Adult. Forehead chestnut-brown; top of head, back and sides of neck, back and wing coverts steel-blue; rump buff, washed with rufous; upper tail coverts dark brown with pale edges; quills and tail dark brown. Lores and space through eye sooty black; under surface yellowish buff marked on the throat with brown and stained on the sides of body and under tail coverts with chestnut-brown. Iris black. Bill and feet light brown. Bill 6, wing 115, tail 56, tarsus 10, mid toe 14 mm. *Immature.* Similar to adult but duller, the back being dark brown with a steel gloss; chestnut band on forehead absent; under surface paler.

Eggs. Clutch three to five, pinkish white, freckled at the larger end with spots of pale reddish brown; 17 x 13, 18 x 12.5 mm. Australia; 21 x 14, 19.5 x 13.5 mm. Tasmania.

Distribution. Occasional visitor. Hicks Bay, Mahia, Featherston, Cape Campbell, Collingwood, Wakapuaka, Blenheim, Mokihinui, Christchurch, Oamaru.

Australia, Tasmania. Migrates to New Guinea, Bismarck Archipelago and Solomon Islands.

Habits. The Tree Martin breeds in Australia and Tasmania, migrating northwards in the winter. The nest is composed of a few dry gum leaves placed in a knot hole in a eucalypt. If the entrance to the hollow chosen is too large it is reduced to the desired size by plastering up with pellets of mud. The Tree Martin arrives in Tasmania at the end of September or early in October and leaves in April.

References.—Vieillot, Nouv. Dict. Hist. Nat., 14, 523, 1817 (*Hirundo nigricans,* Tasmania). Buller, Birds N.Z., 141, 1872; 2nd ed., 1, 74, 1888.

Genus Hirundo

Bill with nostrils longitudinal or oval, a distinct superior membrane. Tail very long, strongly forked, outer feathers much elongated, with a marked indentation on the inner web. Tarsi not feathered. Almost cosmopolitan.

Reference.—Linne, Syst. Nat., 10th ed. 191, 1758 (*Hirundo,* type *H. rustica*).

Welcome Swallow
Hirundo neoxena

The Welcome Swallow, an Australian species, has not been noticed in the main islands of New Zealand but a straggler was taken at the Auckland Islands in 1943 and another at Stewart Island in 1953.

Adult. Forehead and front of crown rufus; head, including band through eye to bill, and back, metallic blue; wing coverts and quills blackish brown, the quills edged with buff; tail dark brown, slightly glossed with green, inner webs of all except central and outermost pair with a white subterminal wedge. Throat, cheeks and breast rufous like the forehead; remainder of under surface greyish white. Bill and feet black. Bill 7, wing 110, tail 75, tarsus 10, mid toe 13 mm. Stewart Island.

Eggs. Clutch four, oval, glossy, pinky white, freckled with small spots of reddish brown. 18 x 13.5, 19 x 13 mm. Tasmania.

Distribution. Auckland and Stewart Islands, stragglers.

Australia. Tasmania.

Habits. In describing the nest of the Welcome Swallow in Tasmania Littler says that it is "composed of small pellets of mud or clay, built up line upon line, mingled with short lengths of grass or straw to give greater adherence to the structure; in shape it resembles a shallow bowl. Many and varied are the places chosen to cement the structure to, some being the side of a cave, a cliff, inside a hollow tree, . . . the date of arrival of the vanguard varies from the first week in July to the first week in September. The date of departure also varies greatly, a number of birds often remaining well into April."

Reference.—Gould, Proc. Zool. Soc., 1842, 131, 1843 (*H. neoxena,* Tasmania).

FAMILY CAMPOPHAGIDAE
CUCKOO SHRIKES

Bill short, decurved at tip, rather wide at base; notched near tip. Nostrils hidden by plumes. Wings long.

Genus Coracina

Bill broad, the culmen sharply ridged. Tail rounded or slightly emarginate. Third to fifth quills longest.

Seven species in New Guinea, Australia

and Tasmania. Accidental in Lord Howe Island and New Zealand.

Reference.—Vieillot, Anal., 37, 1816 (*Coracina,* type *Corvus papuensis* Gmel.).

Black-faced Cuckoo Shrike
Coracina novaehollandiae

This Australian species has been obtained in New Zealand on at least six occasions. The first specimen was shot near Motueka in 1869, the second at Invercargill in April, 1870, and the third at Lake Ellesmere in June, 1904. None of the birds was fully adult judged by there being more or less grey mixed with the black of the throat and upper breast.

Adult. Upper surface light grey; primary coverts black, edged with grey; quills black, edged and tipped with white, outer web of secondaries grey; two central tail feathers grey, blackish towards tip, remainder black, tipped with white, the outermost edged with white on inner web. Forehead, forepart of crown, sides of face and neck, throat and foreneck black; breast and upper abdomen grey; lower abdomen and under wing coverts white; under surface of wings white. Bill black. Feet brownish black. Bill 24, wing 190, tail 140, tarsus 27, mid toe 27 mm. Westport. *Immature.* The black on the head is confined to the sides of face and neck; throat dusky.

Eggs. Clutch three or four, ovoid, dark green, blotched with various shades of umber, chiefly at larger end, 32.5 x 21.5, 30.5 x 22 mm.

Status. As the Black-faced (*C. novaehollandiae*) and the Little Cuckoo Shrike (*C. robusta*) have different life histories, the throat in the former passing from grey to black, whereas in *C. robusta* it passes from dark brown to grey, I regard them as specifically distinct. Several subspecies of the Black-faced Cuckoo Shrike have been defined, but the New Zealand specimens, all of them immature, cannot be placed without comparison with Australian specimens.

Distribution. Motueka. Invercargill. Lake Ellesmere. Okato. Westport. Greymouth. There are several sight records including Port Chalmers, Lake Guyon, and Lake Hawea. A Black-faced Cuckoo Shrike was seen at Pouto, North Kaipara Head, by Mr. W. L. Baker from June to September, 1953.

Breeding in Australia and Tasmania. Migrating north to New Guinea and Bismarck Archipelago, and accidental in Lord Howe Island.

Habits. A Black-faced Cuckoo Shrike appeared at Pouto Point in June, 1953, and was seen in that locality for about four months by Mr. W. L. Baker. He saw it eating worms and taking boxthorn berries on the wing. It stripped off leaves and small pieces of bark and hammered them against a branch before swallowing them.

Writing of the habits of this species in Tasmania, Littler says that its flight is a series of wave-like motions the wings being folded ~~against the body when on the crests.~~ Its food consists of insects and occasionally fruit. The nest is placed high on the dead branch of a eucalypt tree and is constructed of fine twigs and fragments of bark matted together with spiders' webs.

References.—Gmelin, Syst. Nat., 814, 1789 (*Turdus novaehollandiae,* Tasmania). Hutton, Cat. Birds N.Z., 15, 1871 (*Colluricincla concinna,* Motueka); Trans. N.Z. Inst., 5, 226, 1873. Buller, Birds N.Z., 148, 1872; 2nd ed., 1, 66, 1888

FAMILY MOTACILLIDAE. PIPITS

Bill straight, compressed, culmen slightly arched. Primaries nine, first long, inner secondaries lengthened, nearly as long as the primaries.

Includes the Wagtails and Pipits, and is related to the Larks (Alaudidae), agreeing in the long inner secondaries but the larks have the hinder part of the tarsus reticulated, and ten primaries.

GENUS ANTHUS

Bill straight, culmen slightly curved, compressed at tip, widened at base. First to third quills longest. Tail emarginate. Tarsi longer than middle toe and claw; scutellate in front, hinder aspect without scutellations; hind toe long.

About 30 species distributed over the whole world except Polynesia.

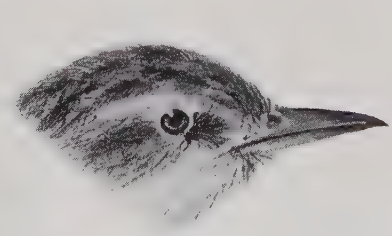
Reference.—Bechstein, Gem. Nat. Deutsch., 3, 704, 1807 (*Anthus*, type *Alauda spinoletta* L.).

New Zealand Pipit. Pihoihoi

Anthus novaeseelandiae novaeseelandiae

The Pipit was discovered in Queen Charlotte Sound during Cook's second voyage by Forster who noticed it on the sea shore feeding on crustacea among seaweed cast up by the waves. Latham, using Forster's drawing, described the "New Zealand Lark," hence the specific name applied by Gmelin. In 1835 Yate referred to the Pipit, noticing that it occurred mostly in fernland and that the male endeavoured to lead intruders away from its nest. When the British Antarctic Expedition under Sir James Ross visited New Zealand in 1840-41, specimens of the Pipit were collected at the Bay of Islands.

Adult. Upper surface fulvous brown, the feathers centred with dark brown; quills and tail feathers dark brown, margined with fulvous; two outer tail feathers on each side white, with brown inner margins; greater coverts and inner secondaries broadly margined with fulvous white. Superciliary streak narrow, white; a dark line through the eye; throat and foreneck white; sides of face and neck, and breast, fulvous white, mottled with dark brown; abdomen and under tail coverts white, the flanks streaked with brown. Bill dark brown, base of lower mandible horn colour. Iris dark brown. Feet yellowish brown. Bill 12-15, wing 84-93, tail 65-80, tarsus 24-25, mid toe 22-23 mm. *Immature.* Similar to adult but feathers of upper surface margined with brownish white and breast more spotted. *Colour Varieties.* Albinos and partial albinos are not uncommon and creamy white examples have been described. A specimen combining albinism and melanism from the East Coast of the Wellington Province is described by T. W. Kirk. Top of head dull black; rest of body and wings creamy white, except the two outer primaries which are normal; outer tail feathers (normally white) jet black.



Margaret A. Morison
NEW ZEALAND PIPIT

Eggs. Clutch three, four or five, broadly ovoid to narrow elliptic, pale creamy with light brown blotches all over and forming a zone at the larger end. 23 x 18, 23.5 x 17.5, 25.5 x 17 mm. Outram.

Status. Very closely allied to an Australian species (*A. australis*). There is a certain amount of variation in the general colour in different individuals of this species. Two well-defined subspecies can be recognised in the New Zealand region, the typical subspecies (*A. n. novaeseelandiae*) described above, and one (*A. n. aucklandicus*) from the southern islands, characterised by its more fulvous coloration both above and below, there being practically no pure white on the under surface. Chatham Islands birds have the feather edgings and under surface more buff than in New Zealand birds.

Distribution. Kermadec Islands (Macauley and Curtis Is.), Three Kings, North and South Islands, Mokohinau, Great Barrier, Little Barrier, Poor Knights, Hen and Chickens, Mayor Island, Kapiti, Chetwode Islands, D'Urville Island, Stewart Island, Chatham Islands. Everywhere abundant except at the Kermadecs where they may be only visitors from New Zealand.

Habitat. The Pipit is abundant in all kinds of open country, preferring the drier stations, from sea level to an altitude of 4,500 feet. It is found in fernland, low scrub and tussock grassland; on sand dunes, sea beaches and coastal rocks; and on shingly river beds. Through the change from forest to settlement, its habitat and food supply have been much increased and the species has increased apace. It has taken kindly to the neighbourhood of exotic pine forests about Whaka-

Okuku River, Canterbury *K. V. Bigwood*
NEW ZEALAND PIPIT

rewarewa and the Kaingaroa Plains. Perhaps the main enemies of the Pipit are harriers but they are reported as sometimes having to flee before a mob of Pipits. Imported vermin and the laying of poison account for some casualties among Pipits.

Food. The Pipit's food consists of all kinds of insects and their larvae, spiders, crustacea, earthworms and occasionally small seeds. Pipits feed on the ground from which they sometimes rise to take insects on the wing. They are entirely useful to the horticulturist and agriculturist particularly as they consume large numbers of grass grubs, the larvae of the beetle *Odontria.* Myers and Atkinson included the Pipit as one of the species of birds that ate cattle ticks, stating that they were informed that it entered the yards of the milking sheds and picked ticks from cattle and from the concrete floor.

Voice. The usual notes may be rendered "pi-pit, pi-pit" in high, usually slurred notes. Another one is a trill usually issued while the birds are sitting on rocks or stumps and occasionally during flight especially while descending to the ground.

Nesting. The breeding season of the Pipit extends from August to February or March, during which time two broods may be raised. The nest is built in a hollow in the ground usually well sheltered and hidden by grass or other low vegetation. Level ground is commonly chosen for a site, but often a steep hillside or cliff is selected. Myers and Atkinson record the finding of a nest with four eggs in the heart of an astelia tussock at an elevation of 4,500 feet on the Tararua Range. The nest is made of grass lined with finer leaves of grass, or, occasionally, fern leaves lined with grass. When investigating the new vegetation on the sea bottom exposed by uplift at the time of the Napier earthquake of 1931, I found a Pipit's nest hidden among grass growing on the dried mud, and built entirely of leaves of *Zostera* or sea wrack, of which there was plenty killed by exposure to the air.

Mr. A. S. Wilkinson informs me that the period of incubation is 15 days and the young leave the nest when 15 or 16 days old. They are fed by the parents, on insects, altogether for about three weeks. During the breeding season the Pipit is found in pairs but in the autumn it congregates into flocks, dispersing again in early spring.

References.—Gmelin, Syst. Nat., 799. 1789 (*Alauda novaeseelandiae*, Queen Charlotte Sound). Buller, Birds N.Z., 132, 1872; 2nd ed., 1, 63, col. pl. 1888; Suppl., 2, 151, 1905. Lorenz-Liburnau, Ann K.K. Hofm. Wien. 17, 308, 1902 (*A. n. reischeki*); 309 (*A. n. chathamensis*). Fleming, Emu, 38, 504, 1939. Buddle, Bird Secrets, 24, 1951. Wilkinson, Kapiti Bird Sanct., 110, 1952.

Southern Islands Pipit

Anthus novaeseelandiae aucklandicus

Pipits were first collected on the Auckland Islands during the visit of the British Antarctic Expedition in 1840. These were sent to the British Museum and later, in 1862, were named by Gray as a species The next specimens to be collected on the Auckland Islands were obtained by Reischek in 1888. On Campbell Island H. Armstrong noted Pipits in 1869, and specimens were collected by Lord Ranfurly in 1901. Reischek, in 1888, was the first to collect Pipits on Antipodes Island, and noting the different coloration from New Zealand birds he described them as a new species. Lord Ranfurly, in 1901, was the next to take Pipits on Antipodes Island. Pipits were observed at the Snares in 1890 by F. R. Chapman, and in 1907 by E. R. Waite but the subspecies is uncertain as no specimens were collected.

Adult. The subspecies *aucklandicus,* as typified by Auckland Island birds, is distinguished from the subspecies on the main islands of New Zealand by its stouter bill and its fulvous coloration both above and below. The superciliary streak is obscure; the brown markings on the upper surface do not stand out conspicuously because the edges of the feathers are brownish fulvous; under surface fulvous with an indistinct breast band of darker fulvous with narrow brown streaks. Antipodes Island birds seem to be more fulvous than those from the Auckland Islands. Reischek describes them as follows: *Male*: Upper surface dark brown, each feather with a light brown edge; the outer half of the two outside tail feathers a cream colour; throat and breast cream colour with a few brown streaks; abdomen light pinkish brown; eyes dark brown; bill and legs brown. Bill 14-16, wing 85-93, tail 66-70, tarsus 23-26, mid toe 22-25 mm. *Females* are described by Reischek as "upper surface, wings, and tail like the male, but lighter; throat, breast, and abdomen rusty yellow, a few oblong brown streaks on the breast; measurements slightly smaller." An *immature* bird from the Auckland Islands is thus described by Buller: upper surface strongly suffused with fulvous, quills and their coverts and the tail feathers broadly margined with fulvous; outer tail feathers pale fulvous; face, throat and under surface entirely fulvous, the feathers of the foreneck and breast obscurely centred with brown.

Eggs. Ovoid, pale grey closely blotched all over with light and dark brown, 23 x 18, 26 x 16 mm.

Status. That the fulvous coloured Pipits of the Southern Islands are subspecifically distinct from the Pipits of the main islands is evident enough. The question still to be answered is whether a different form can be defined for each island group, as was accepted by Lorenz-Liburnau for Auckland and Antipodes Islands birds. If the Snares birds are visitors only, then it is not known whether they came from Stewart Island or the Auckland Islands and consequently their subspecific location is not determined.

Distribution. Auckland, Campbell and Antipodes Islands. Reported on the Snares on two occasions but no specimens collected, and none seen during two expeditions to the group in 1947 and 1948.

Habits. At the Auckland Islands the Pipit is common from the sea shore to the tussock uplands. It is very tame, coming quite close to anyone visiting the islands. On the shore it feeds among the intertidal rocks and the seaweed cast up at high tide mark. At the Antipodes Islands it is equally common and tame. Here it associates with two species of parakeet among the colonies of penguins where there is an abundance of insects that feed on the waste products of the penguins. The Pipits also find crustacea among seaweed on the tidal rocks and cast up on the shore. Pipits are also found and are common in the tussock country of the upper parts of the island.

References.—Gray, Ibis, 1862, p. 224 (*Anthus aucklandicus,* Auckland Islands). Buller, Suppl. Birds N.Z., 2, 153, 1905. Reischek, Trans. N.Z. Inst., 21, 388, 1889 (*Anthus steindachneri,* Antipodes Island).

FAMILY SYLVIIDAE
WARBLERS

Bill slightly arched, slender. Wings with short first primary. Tail of ten or twelve feathers.

Key to New Zealand Genera

- Tail longer than wing, barbs disconnected .... *Bowdleria*
- Tail equal to or shorter than wing, barbs connected.
  - Shafts of tail feathers projecting .... *Mohoua*
  - Shafts of tail feathers not projecting .... *Finschia*

GENUS BOWDLERIA

Bill with a sharp ridge and faintly marked notch near tip of upper mandible. Fourth to sixth primaries longest. Tail feathers 10, graduated, long and pointed, stiff, barbs disconnected.

The New Zealand fernbirds were said by Sharpe to be aberrant warblers, but they differ from the true Sylviidae in the short wings and longer first primary. They are possibly related to the grassbird (*Megalurus*) of Australia.

Key to Species and Subspecies

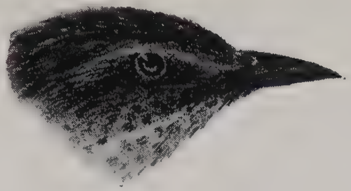
- Throat and breast spotted.
  - Upper surface brown.
    - Sides brown.
      - Spots smaller .... *B. p. vealeae*
      - Spots larger .... *B. p. punctata*
    - Sides rufous .... *B. p. stewartiana*
  - Upper surface rufous.
    - Heavily spotted .... *B. p. wilsoni*
    - Lightly spotted .... *B. p. caudata*
- Whole under surface without spots .... *B. rufescens*

Reference.—Rothschild, Nov. Zool., 3, 539, 1896 (*Bowdleria*, type *Synallaxis punctata* Quoy and Gaim.).

North Island Fernbird
Bowdleria punctata vealeae

Yate in 1835 mentioned the Fernbird among the birds of the Bay of Islands. He said that it lived among the rushes in swamps, was remarkably tame and seemed to have no fear of man. Dieffenbach in 1840 noticed it in Typha swamps and amongst fern.

Adult. Upper surface light rufous brown with dark brown centres to the feathers; crown chestnut; quills and their coverts, and tail feathers dark brown margined with light brown; superciliary streak white; under surface grey spotted with dark brown; centre of abdomen without spots; flanks brown spotted with dark brown. Bill 10-12, wing 55-62, tail 75-102, tarsus 19-22, mid toe 15-19mm.



Margaret A. Morison

NORTH ISLAND FERNBIRD

Eggs. Clutch three, pinkish with purplish and light brown spots all over and aggregated at the larger end. 18 x 14, 18 x 14.5. Rangitoto Range.

Status. *Bowdleria punctata* is here accepted as consisting of five subspecies. Possibly there are more definable forms as birds from the Bay of Islands are larger in bill and tail, and more rufous than in the usual North Island form. *B. p. vealeae* is very close to the South Island *B. p. punctata*, the main difference being in the smaller size of the black spots and blotches of North Island birds. Gray's *B. fulvus* which Kemp thinks came from the South Island and invents a locality for it, is, judging by its small spots, probably a North Island bird, in which case the name *fulvus* would displace *vealeae*. I have seen no specimens that could be described as fulvous except faded ones, and would suggest that Gray's name be dropped as indeterminable.

Distribution. Formerly abundant throughout the North Island but, owing to reduction of swampy areas, now much less widely distributed though still plentiful where it can find suitable conditions. Parengarenga to Cape Palliser. Great Barrier Island. Alderman Islands. Three Kings Islands (sight record, 1887).

Habitat. The extensive swamps of raupo (Typha), toe-toe-upukutangata (Mariscus), flax (Phormium) and niggerhead (Carex) are the home of the Fernbird. It also frequents the neighbouring fernland, open scrub and even the exotic forests of pines. Guthrie-Smith said that the Fernbird had gained by settlement and some recent reports state that it is increasing in numbers in some localities. But the wholesale draining of swamps has certainly reduced the areas it formerly favoured.

The Fernbird runs up and down the raupo leaves or fern stalks, taking short leaps from one to another, but seldom takes flight. When it does it flies a few yards only, perhaps forty or fifty, with its tail hanging down. When climbing, its tail seems to be used as a support.

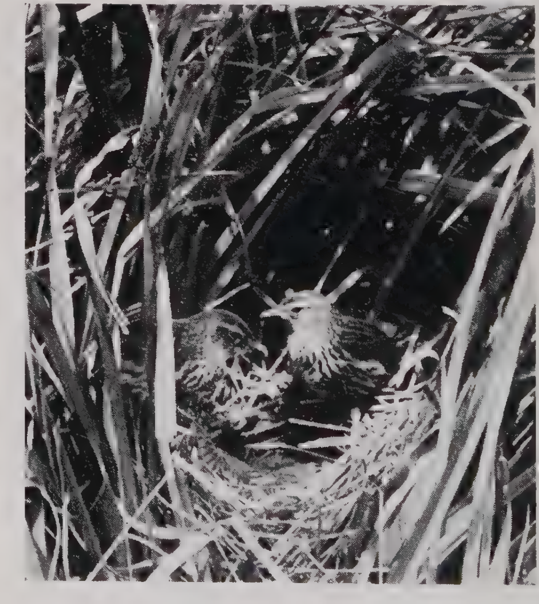
Food. Its food consists so far as is known entirely of insects. These are taken among the vegetation and on the ground.

Voice. Its ordinary cry is rather a monotonous double note, generally vocalised "utick," besides which it has various other calls most, however, in the nature of sharp monosyllabic or double notes. More than one observer has given his opinion that a double note such as utick is really produced by two birds one rapidly answering the other.

Nesting. A detailed account of the breeding habits of the Fernbird in the East Cape district has been published by M'Lean and it is from his observations that the following is quoted: "The nest is usually placed right in the centre of and low down in a tussock growing in or near the edge of a swamp. . . . The nest is so strongly constructed as to appear like a miniature wicker basket from which a quantity of feathers have been emptied, a few still remaining attached to the inside. The walls are very neatly woven, and the only ragged part is the base. The walls and foundations are composed wholly of fine, dry grass stems. The lining consists of a single layer of feathers, usually the larger contour feathers of pukekos and ducks.

"Both birds assist in building and tending the young. The eggs are laid daily, evidently in the morning and incubation lasts 12½ days, the young leaving the nest about the fifteenth day. The young are born absolutely naked and blind, not a trace of down showing, but on the second day the quill feathers of wing and tail are just breaking. The eye is fully open on the third day."

A nest containing three eggs found in a swamp in the Rangitoto Ranges in February, 1925, is described by the finder in the following words: "The nest was entirely concealed, and a 'burrow' about a foot in length, on the top of the dead rushes, led to the northern side of the rush 'tent,' emerging beside a little tea tree, which served as both screen and threshold. The nest was situated in a tent-like ridge of ranker rushes where two different 'lies' of growing rush met. It was built about two feet from the water, just on top of the dead rush from previous years, and was partly supported by this, and partly by some half dozen rush leaves passing through the rim of the nest. The nest was composed of pieces of dry rush loosely woven together, and the nest cavity, about two inches in width, slightly oval in shape, and



Tutira, Hawke's Bay *H. Guthrie-Smith*

NORTH ISLAND FERNBIRD

two and a half inches deep, was lined with blades of a small variety of rush."

References.—(?) Gray, Ibis, 1862, 221 (*Sphenoeacus fulvus*). Buller, Birds N.Z., 128, 1872; 2nd ed. 1, 59, 1888. Kemp, Austr. Av. Rec., 1, 124, 1912 (*B. p. vealeae,* Hokianga). M'Lean, Emu, 6, 1, 1906. Guthrie-Smith, Birds, Water, Wood, Waste, 146, 1910. Buddle, Bird Secrets, 25, 1951.

South Island Fernbird

Bowdleria punctata punctata

The Fernbird was discovered in 1827 by Quoy and Gaimard, naturalists to the French expedition which visited New Zealand in the *Astrolabe.* According to these observers it inhabited marshy places at Astrolabe Bay where it was noticed climbing the stems of reeds and flax. Potts in 1870 was the first to publish an account of the nesting habits of the South Island Fernbird.

Adult. Upper surface light rufous brown with broad longitudinal dark brown marks; top of head rufous with narrow brown spots; quills and their coverts and tail feathers dark brown, margined with fulvous. Superciliary streak white; under surface fulvous-white, except lower abdomen spotted with black, the flanks buffy rufous blotched with dark brown. Bill horn colour, dark brown on the culmen. Iris black. Feet pale brown. Bill 11-14, wing 58-65, tail 80-106, tarsus 19-22, mid toe 15-20 mm.

Eggs. Clutch three, occasionally four, ovoid, white, speckled with reddish brown. 20 x 15, 21 x 15 mm. Rockwood, Canterbury.

Status. The chief character which separates the South Island from the North Island Fernbird is the larger size of the black spots and blotches of the South Island form. Quoy and Gaimard describe the upper surface as rufous brown and their figure, which is bad, agrees with the description. The type of *Bowdleria punctata* is not, therefore, different in general coloration from the North Island representative. Probably the two forms should be united as one subspecies.

Distribution. South Island from Astrolabe Bay to Foveaux Strait, fairly numerous in suitable, usually swampy, places. It is absent or rare in most parts of Marlborough and Canterbury, and many parts of Otago. It is most common in Westland. Open Bay Islands, subspecies unknown.

Ecology. Writing about the Fernbird in Canterbury in 1884 Potts said: "At one time very commonly met with about the swamps and round the edges of lagoons where the coarse water grasses grew rankly; its numbers now appear to be very much lessened, as the swamp lands have been reclaimed and cultivated. It now haunts the sedges and coarse herbage that fringe boggy creeks." The very feeble powers of flight are unable to save it from bush fires, remarks Potts. Stead says that the Fernbird has been extinct in Canterbury since about 1898.

Bathgate was of the opinion that the burning of grasslands was the cause of the Fernbird's extinction in many parts of Otago. He also thought that dogs bore a part in this process.

Nesting. In Canterbury Potts found the nest of the Fernbird most frequently in a tussock a few inches above the level of the ground. The nest was made of grass leaves with a few feathers, usually those of the Pukeko, added to the inside. The usual number of eggs was three though Potts has found four in a nest. Both eggs and young were found in early November.

References.—Quoy and Gaimard, Voy. Astrol. Zool., 1, 255, 1830 (*Synallaxis punctata,* Tasman Bay). Potts, Trans. N.Z. Inst., 2, 57, 1870; N.Z. Jour. Sci., 2, 283, 1884. Buller Birds N.Z, 130, 1872; 2nd ed., 1, 61, 1888.

Stewart Island Fernbird

Bowdleria punctata stewartiana

The first record of a Fernbird on Stewart Island of which I am aware is that of Dr. L. Cockayne in his account of the botany of the island published in 1907. In 1914 Guthrie-Smith described the habits of this subspecies in the Rakiahua Valley. He mentions a different form breeding at Mason Bay but this has not yet been identified.

Adult. Top of head rufous streaked with black; back similar but not so reddish and with large blackish brown blotches; quills brown, rufous on outer margins. Chin white with fine spots; breast similar but spots larger; abdomen fulvous white with scattered longitudinal spots on flanks; lower abdomen and under tail coverts rufous buff. Bill 10.5-12, wing 57-61, tail 80-83, tarsus 20-22, mid toe 16-17.5 mm.

Eggs. Clutch two or three, pale pinkish with reddish brown dots all over but concentrated in a band round the larger end. 21.8 x 15.8, 22.6 x 15.4, 24 x 15.8 mm. Cundy Island.

Status. Differs from *B. p. punctata* in the richer rufous brown of the upper surface, especially the crown, and the browner sides of the breast and abdomen. Both Stead and Guthrie-Smith report two forms of Fernbird in the Stewart Island region but specimens of only one of the kinds have been collected.

Distribution. Stewart Island, and the outlying islands Big South Cape, Solomon, Pukeawa, Cundy and Jacky Lee.

Habits. Stead's note with eggs he collected state that this Fernbird on Cundy Island nests in low bushes, reeds or grass. In the Rakiahua Valley in Stewart Island Guthrie-Smith found it abundant. Of its breeding habits he says "He was plentiful in the clumps of red tussock, along the margins of the deep half-choked peat burns and in the stunted thickets of box-leaved koromiko and grass tree; and it was this spring I discovered him to be very common in the stunted wind blown manuka on the very edge of the open moors of the mountain tops." Guthrie-Smith described it as a strong flier, continuing in the air for sixty or eighty yards, and climbing to the tops of the low trees fringing the river's edge. A nest "was placed about four feet above ground, and was well hidden in a manuka bush thick and bushy to the root. . . . Within ten minutes of birth, the cock bird had brought, and the chick received, a green caterpillar."

Stewart Island *H. Guthrie-Smith*
STEWART ISLAND FERNBIRD

References.—Oliver, N.Z. Birds, 451, 1930 (*B. p. stewartiana,* Cundy Island). Stead, Trans. Roy. Soc. N.Z., 66, 312, 1936 (*B. p. insularis,* Cundy Island). Guthrie-Smith, Mutton Birds, 15. 1914.

Codfish Island Fernbird

Bowdleria punctata wilsoni

Mr. E. F. Stead discovered this subspecies on Codfish Island in 1935 and on his specimens defined a new subspecies which he called *wilsoni.*

Adult. Upper surface with large black spots on a light rufous ground, the spots being quite large on the head; tail brownish black. Under surface from chin to abdomen with large black spots; flanks pale rufous. Large birds with stout bills. Darker than any of the other subspecies of *punctata.* It differs from the mainland forms in being more rufous, having a stouter bill, an ill defined superciliary streak, and the throat thickly covered with large black spots. Bill 12-14, wing 61-65, tail 85-103, tarsus 21-23, mid toe 17-18 mm.

Distribution. Codfish Island, off Stewart Island.

Habits. Stead notes that this Fernbird is not uncommon in those portions of Codfish Island not covered with heavy bush. It was met with in the scrub and fern along the beach as well as in the scrub in the higher portions of the island. One deserted nest was found in the top of a thick scrub bush heavily hung with convolvulus. It was made of grass with a deep cup the bottom of which was lined with feathers.

Reference.—Stead. Trans. Roy. Soc. N.Z., 66. 312, 1936 (*B. p. wilsoni*, Codfish Island).

Snares Island Fernbird

Bowdleria punctata caudata

This subspecies was first collected at the Snares by Reischek in 1888. Six years later H. H. Travers obtained specimens some of which came into Buller's hands and were described as a new species. Its habits have recently been studied by Stead and Richdale.

Adult. Upper surface and sides rufescent, faintly streaked with dark brown; tail uniformly rufous brown; superciliary streak indistinct. Throat and breast fulvous spotted with black, centre of abdomen fulvous. Bill and feet brown. Iris hazel. Bill 14-16, wing 68-74. tail 80-100, tarsus 22-24, mid toe 20-22 mm.

Eggs. Clutch two or three, ovoid, pale mauvy pink heavily spotted over the whole surface with minute spots of red and mauve. The second and third laid eggs are paler. 21.5 x 16.5, 23.5 x 16.5, 24.5 x 16.5 mm.

Status. Differs from the other subspecies of *B. punctata* in its larger size and rather uniform rufous brown coloration, the black streaks being obscure; from *B. rufescens* it differs in its spotted throat and breast and less bright rufous coloration. The bill and feet are robust and the tail feathers blunt at the tip with the barbs closely set.

Snares Island *L. E. Richdale*
SNARES ISLAND FERNBIRD

Distribution. Snares Islands.

Habits. There are no swamps on the Snares. Nevertheless the ground and the vegetation are generally wet so the Fernbird lives in a habitat not unlike that of Stewart Island. It is abundant all over the island and is to be seen creeping about the ground among the tussock and shrubs and in the low Olearia forest where it climbs the leaning trunks. Fernbirds are especially plentiful along the shore where penguins congregate, and in the penguin colonies further inland. In such places they find insects and their larvae in plenty. Guthrie-Smith watched a newly hatched young being fed with maggots.

Several weeks were spent on the Snares by L. E. Richdale and W. M. C. Denham studying the bird life. Richdale states that all the nests found were built in tussocks close to the ground. "When the young leave the nest, even after they have developed the ability to hunt for and collect their own food, they are fed for many weeks by the parents. Fernbirds feed largely on the ground foraging for and collecting insects under leaves and other small objects by lifting them with their feet. They are adepts at chasing and catching flies. Whenever Sea Lions and Sea Elephants are in the vicinity the birds run quickly about as the mammals move catching the insects and the flies that have been disturbed."

Stead states that the nesting season, judging by the size of some of the young birds in early December, commences about the beginning of October. Concerning the nest Stead says: "The favourite site for the cup-shaped nest is in a thick clump of black fern or broad-leaved grass. In open situations, thick beds of shiny fern are also much used. First a deep hollow is made, wherein an outer layer of fine rootlets is lined with grass, *Poa foliosa* being almost exclusively used for the purpose. As is the case with the mainland fernbirds only the lower half of the deep cup is lined with feathers. The nest is tightly packed into the cavity which has been formed for it, so that the whole of the outside is supported by the surrounding material. We found a great many nests and all of them without exception were in situations where they would be well sheltered from rain. . . . The Snares fernbird flies more readily than the species inhabiting the mainland, and it is not unusual to see birds voluntarily undertaking flights of 50 yards or more, indeed I once saw one fly with building material for over 100 yards. Their food supply seems to consist of white maggots which they get out of the ground, mostly from the penguin colonies but birds were seen foraging for insect food among the dead leaves on the floor of the bush, or on the bark and among the branches of the trees themselves. Both birds incubate, and I never saw on any occasion one adult feeding another. One bird which was feeding young in a nest collected maggots from a dead seal which was lying on the rocks, taking bills full of this unsavoury diet to the young at frequent intervals. The young, when they first leave the nest, are almost square-tailed, and the parent birds evidently very soon begin to build another nest, for on one occasion I saw a pair of birds, accompanied by a young one which had not been flying for more than a few days, building a new nest in a clump of fern."

References.—Buller, Trans. N.Z. Inst., 27, 127, 1895 (*Sphenoeacus caudatus,* Snares); Suppl. Birds N.Z., 2, 132, 1905. Stead, N.Z. Bird Notes, 3, 75, 1948. Richdale, Island Outpost, 114, 1948.

Chatham Island Fernbird

Bowdleria rufescens

This species was discovered by Mr. Charles Traill in 1868 on Mangere Island in the Chatham Group. Traill observed a small bird among the grass and stunted vegetation and knocked it over with a stone. It was forwarded to Buller who described it as a new species. In 1871, H. H. Travers found the species to be not uncommon on Mangere. Through burning and the introduction of cats on Pitt Island, and collectors on Mangere, the Chatham Island Fernbird became extinct about twenty-five years after its discovery.

Adult. Upper surface dark rufous brown, the wing coverts and scapulars broadly centred with brownish black; quills dark brown margined with rufous brown; tail feathers rufous brown with black shafts; a brownish black patch from bill through eye to ear coverts. Superciliary streak, throat, breast and abdomen fulvous white, a group of black spots below the eye and minute light brown spots on the breast; sides of body rufous brown, each feather with a central streak of black. Bill light brown, culmen black. Feet yellowish brown. Bill 12-15, wing 56-66, tail 90-110, tarsus 25-26, mid toe 20-22 mm. *Colour Varieties.* Partial albinos have been reported by Hutton and Buller.

Eggs. Broadly ovoid-conical, creamy white, covered all over with a speckled or marbled graining of reddish brown. 20 x 17 mm.

Status. In the Chatham Fernbird the absence of spots on the under surface, except for some minute and inconspicuous ones on the breast, and the bright rufous colouring of the upper surface, contrast with the spotted under surface and more or less brownish upper surface of the other forms of *Bowdleria.* Its separation as a species consequently makes a natural division of the genus. The nearest related subspecies of *B. punctata* is the Snares Fernbird, a form that, like the Chatham Island Fernbird, has been separated from the other subspecies for a very long time.

Distribution. Chatham Group, formerly on Pitt and Mangere Islands. Now extinct. Fleming believes that it may still exist on an inaccessible scrub covered slope on Mangere Island.

Habits. The only information regarding the habits of this bird is a note by H. H. Travers who visited the Chatham Islands in 1871. He says, "I only found this bird on

Mangere, where it is not uncommon. Its peculiar habit of hopping rapidly from one point of concealment to another renders it difficult to secure. It has a peculiar whistle, very like that which a man would use in order to attract the attention of another at some distance. It also uses the same cry as *Sphenoeacus punctatus.* It is solitary in its habits and appears to live exclusively on insects."

References.—Buller, Ibis, 1869, 38 (*Sphenoeacus rufescens,* Chatham Is.); Birds N.Z., 131, col. pl. 1872; 2nd ed., 1, 62, 1888. Rothschild, Extinct Birds, 21, col. pl. 1907.

GENUS MOHOUA

Bill stout, compressed. Fourth to sixth quills longest. Tail feathers frayed at ends, the shafts projecting. Feet stout.

The species of this genus are distinguished by the stout bill and feet and the frayed tail feathers, and recognised in the field by the brown plumage with white or yellow head and under surface.

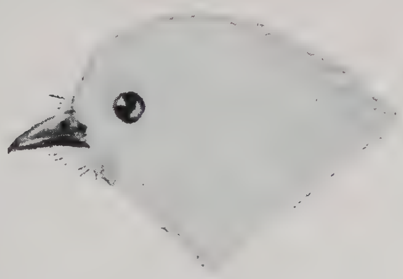
Key to Species

Head and under surface yellow *M. ochrocephala*
Head and under surface white ...... *M. albicilla*

References.—Lesson, Compl. Oeuv. Buff., 9, 139, 1837 (*Mohoua,* type *Muscicapa ochrocephala* Gmel.). Lafresnaye, Revue Zool., 1842, p. 69 (*Certhiparus,* type *Fringilla albicilla* Lesson).

Whitehead. Popokatea
Mohoua albicilla

When the French expedition under Duperrey visited the Bay of Islands in the *Coquille* in 1824, Lesson, the naturalist, obtained a specimen of the Whitehead which he afterwards described in the report of the zoology of the voyage. Yate in 1835 describes white-headed birds at the Bay of Islands under the names tatariki and tataiato. The species was obtained in the same locality by the British expedition under Sir James Ross in 1841, while P. Earl collected it at Port Nicholson about the same time.



E. H. Atkinson
WHITEHEAD

Adult. Head, neck all round, breast, middle of abdomen and under tail coverts white, slightly tinged with brown; upper surface vinous brown, paler on the upper wing coverts; quills dark brown, margined on outer web with grey and on inner with yellowish white; upper tail coverts and tail pale yellowish brown. Sides of body pale vinous brown. Bill and feet black, the claws brown. Iris black. Bill 9.5-11, wing 68-75, tail 67-71, tarsus 24-25, mid toe 18-20 mm. *Immature.* Upper surface pale vinous brown, whitish on head; under surface greyish white.

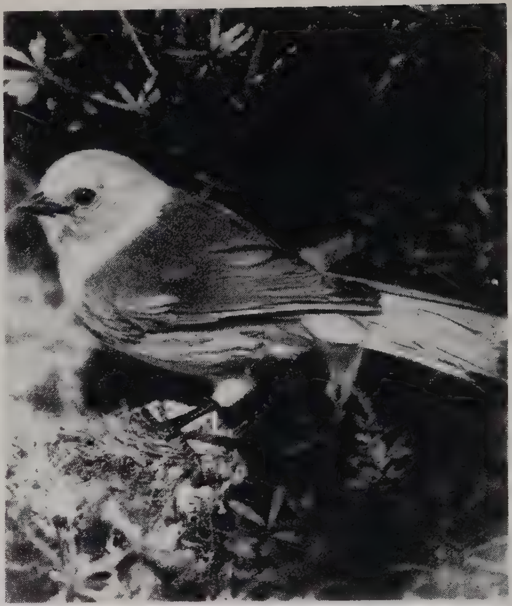
Eggs. Clutch two to four, white or pinkish with pale brown spots, 22 x 17, 23 x 16 mm. Kapiti (Wilkinson).

Status. Though the colour pattern allies the Whitehead to the Yellowhead there are a number of structural differences which separate them. In the Whitehead the bill and feet are weaker than in the Yellowhead. In fact the Whitehead comes close to *Finschia* in these characters. In the Whitehead the hind toe is shorter. The fraying of the tail feathers is an artificial character due to wear. It is less marked in the present species than in the Yellowhead.

Distribution. Formerly abundant throughout the North Island, Little and Great Barrier Islands and Kapiti. Now found in forested districts on the mainland from the Pirongia and Coromandel Ranges southwards, including Mount Egmont and the mountain system from the East Cape to Cook Strait; also Little Barrier, Great Barrier and Kapiti Islands.

Ecology. Like its yellow-headed relative, the Whitehead is essentially a forest bird. It is perhaps most frequently seen high up in the trees, but it often prefers the lower manuka bush as on Little Barrier Island, while on Kapiti, according to Wilkinson, it frequents low shrubs on the edge of the bush. Restless, noisy and inquisitive, it comes crowding down to investigate any visitor to its domain, and, apparently after being satisfied, moves on. It is found in flocks throughout the winter but in spring these disperse to breed. The flocks are often accompanied by other birds, perhaps taking advantage of the insects disturbed by the Whiteheads, though another suggestion is that some of the birds accompanying the flock act as guards. Thus W. W. Smith writes of the Whiteheads in Taranaki: "They were invariably accompanied by a pair of Saddlebacks, or Tieki, who seemed to act as guardians of the flock, giving the alarm when anyone approached, with their sharp notes." In a different locality, namely the East Cape district, and at a later date when the Saddleback had almost disappeared from the North Island, M'Lean wrote as follows: "Here on the birch-wood ridges, I found *Cyanorhamphus auriceps* invariably accompanying the winter flocks of *C. albicapilla.* Besides the Parroquets, Blight Birds, Fantails and Warblers—one, or other, or all—were sometimes in attendance. The Whiteheads keep more forward in the lower tops, hunting methodically and with a few harsh notes; over them in the highest part of the trees, are several Parroquets acting as scouts, with hesitating style and chattering softly; a few Blight Birds are calling close on the heels of the Whiteheads; a Fantail or two plays carelessly about on the wing, while an odd silent Warbler is busy among disturbed insects. Such was the composition of these flocks on most occasions and always so when, in fine weather and with great regularity, the morning movement took place past our camp about an hour after sunrise."

The Whitehead is a favourite victim of the Long-tailed Cuckoo which either through its parasitic or predatory habits must account for a large number of nestling Whiteheads. Wilkinson notes that of eight Whitehead's nests found by him in one season, in only one was a brood reared. The others were destroyed by Long-tailed Cuckoos and other causes.



Kapiti Island *A. S. Wilkinson*

WHITEHEAD

The Whitehead, once common everywhere in the North Island, has disappeared over large areas through the clearing of the forest. Indeed it is said to have vanished from some localities before the bush was felled. It does not take kindly to the settled districts though it has invaded the exotic pine plantations in the Whakarewarewa-Kaingaroa Plains area, where it is reported to be increasing in numbers. The Whitehead early disappeared from the north of Auckland, the last record of its presence being about 1875. In some of the southern districts reports indicate an increase in numbers.

Food. The food of the Whitehead consists mainly of insects which it industriously seeks among the branches and stems of trees, and also from rotten logs and the ground. Small soft fruits, like the mahoe (Melicytus) and tree seeds such as the kohuhu (Pittosporum) and tawari (Ixerba) are also eaten.

Voice. Proceeding continuously from a flock of Whiteheads is a short single note which may be vocalised "cheet." When the birds are alarmed, this note becomes harsher and louder, and if excited it sounds more like a rapidly repeated "chee." Besides these chattering notes, Andersen states that there is a true song of which he gives several examples in his book on bird song.

Nesting. The Whitehead generally selects for the site of its nest the denser portions of a manuka or other small tree. Of the many nests found by Mr. and Mrs. Stidolph most were built in manuka trees, but tauhinu and coprosma shrubs were also used. In the Urewera country St. Paul states that the Whitehead usually builds its nest on a tree fern leaf between a foot and two feet from the trunk. The nest is rather a compact structure of moss, grass, leaves and bark bound together with spider webs and lined with fine grass, tree-fern scales and a few feathers. The usual laying months are October to December but Mr. Wilkinson informs me that on Kapiti Island the breeding season lasts from October to February, and that both parents assist in building the nest and incubating the eggs. The period of incubation as determined by Wilkinson is 17 days and the young remain in the nest from 14 to 18 days.

A remarkable discovery concerning the breeding habits of the Whitehead was made by Guthrie-Smith during an ornithological investigation on Little Barrier Island. He found out that two pairs use the same nest for breeding purposes. He states that in addition to three nests which he had under the camera, and two broods attracted down from the tops of the trees, there were innumerable cases of families which he considered were fed by four parents. He concluded, however, that although in the majority of cases a Whitehead's nest is run by a quartette, there are cases where a pair may own a nest. In these, two eggs was the normal number but in nests shared by two females the number of eggs was always three.

References.—Lesson. Voy. Coquille, Zool., 662, 1828 (*Fringilla albicilla,* Bay of Islands). Gray, Zool. Erebus and Terror, Birds, 6, col. pl. 1845. Buller, Birds N.Z., 101, col. pl. 1872; 2nd ed., 1, 53, col. pl. 1888. M'Lean, Ibis, 1907, p. 531; Emu, 11, 173, 1912. Andersen, Bird Song, 69, 1926. Guthrie-Smith, Bird Life, 73, 1925. Wilkinson, Emu, 26, 245, 1927; Kapiti Bird Sanct., 66, 1952. Buddle. Bird Secrets, 17, 1951.

Yellowhead. Mohua
Mohoua ochrocephala

The Yellowhead was one of the species discovered by the Forsters at Queen Charlotte Sound during Cook's second voyage. A drawing made by G. Forster was the basis of Latham's description of the "Yellow-headed Flycatcher," and this was adopted by Gmelin when applying a binomial name. Quoy and Gaimard collected the Yellowhead at Tasman Bay during d'Urville's voyage in 1827, and Captain Stokes obtained specimens and forwarded them to the British Museum about 1850.

Adult Male. Head, breast, upper abdomen and sides canary-yellow; upper surface yellowish brown; quills brown, the outer margins olivaceous yellow, the inner pale yellow; wing coverts and upper tail coverts brownish yellow; tail olivaceous yellow. Lower abdomen greyish white; under tail coverts yellow. Iris, bill and feet black, claws brown. Bill 11-14, wing 79-85, tail 70-74, tarsus 26-29, mid toe 20-22 mm. The *female* is similar to the male but less yellow on the upper surface. *Immature.* The yellow plumage is tinged with olivaceous, especially on the top of the head and hind neck.

Eggs. Clutch three or four, ovoid to elliptic, pink with pale and dark reddish brown blotches and spots all over and sometimes forming a band at the larger end. 23 x 18, 23.5 x 17.5 mm. Fultons Bush. 24 x 19 mm. Okarito.

Status. The distinctive characters of the Yellowhead ally it to the Whitehead so that it is proper to associate them in the same genus. But the Yellowhead differs from the Whitehead in its yellow coloration, stouter and longer bill, graduated tail and longer hind claw.

Distribution. Formerly plentiful throughout the South Island and Stewart Island. Now found in forested areas in Marlborough and all western districts. Plentiful in some localities. A few birds still exist in the Dunedin area but they have gone from D'Urville Island and there are no recent records from Stewart Island.

Ecology. The Yellowhead is characteristic of the gloomy beech forests of the South Island. It keeps to the interior of the forest generally in the upper parts of the trees but will flock down in the manner of the Whitehead to any one passing through the bush.

It moves about in small parties uttering continually its short musical notes. Formerly these parties were closely attended by saddlebacks which it is supposed associated with the Yellowheads for the purpose of catching the insects they disturbed. Now the saddleback is gone but the cheerful parties of Yellowheads are still to be encountered in many parts of the South Island often accompanied through the forest by a few parakeets.

The clearing of the forest has been disastrous to the Yellowhead which persists only in tall bush. Hence it has disappeared from such outlying places as D'Urville Island and Banks Peninsula, also, except for a few localities, the whole of Canterbury and eastern Otago. It is the dupe of the Long-tailed Cuckoo which means that many of its young are destroyed.

Food. The Yellowhead seems always to be busily engaged in searching the tree for insects. It carefully examines the trunks and branches and their growth of mosses and lichens and it also feeds on the ground. It uses its feet parrot fashion for holding large insects while eating them.

Nesting. The nesting site of the Yellowhead is generally a large broadleaf or beech tree. The nest is placed from forty to sixty feet above the ground in a natural hole in the trunk. It is a compact cup-shaped structure built of moss, grass and leaves neatly bound together with spider webs and lined with fine grass and sometimes feathers. The laying season is November and December. According to Guthrie-Smith the incubation period is about 21 days and the female when sitting is fed on insects by the male either by calling her off the nest or giving the food to her while on the nest. The chicks when first hatched are, says Guthrie-Smith, naked and black but in a week's time are covered with grey blue down. They leave the nest when about two weeks old. The feeding of the young is described by Mrs. M. M. Moncrieff as a rather noisy affair. "Hearing a peculiarly harsh call, one would gaze up and see the parents hopping rapidly from branch to branch half-way up a tree, followed flutteringly by the young family with much chirping and movement of wing to emphasize that they were hungry. Occasionally the young sat huddled side by side on a branch waiting for the parents to return and feed them."

References.—Gmelin, Syst. Nat., 944, 1789 (*Muscicapa ochrocephala,* Queen Charlotte Sound). Quoy and Gaimard, Voy. Astrol. Zool., 1, 223, col. pl. 1830 (*Certhia heteroclites,* Tasman Bay). Buller, Birds N.Z., 103, col. pl. 1872; 2nd ed., 1, 56, col. pl. 1888. Moncrieff, Emu, 25, 21, 1925. Guthrie-Smith, Sorr. Joys N.Z. Nat., 67, 1936.

GENUS FINSCHIA

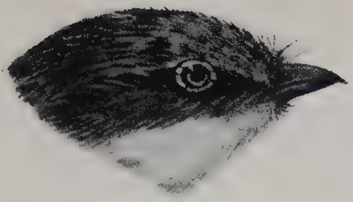
Bill slender, compressed, curved; nostrils operculate and partly concealed by plumes. Fourth to sixth quills longest. Tail long, rounded. Tarsi slender.

Distinguished from Mohoua by the slender bill and tarsi and the relatively longer tail of which the feathers are not frayed nor the shafts projecting. A single species confined to New Zealand.

Reference.—Hutton, Ibis, 1903, p. 319 (*Finschia,* type *Parus novaeseelandiae* Gmel.).

Brown Creeper. Pipipi
Finschia novaeseelandiae

The Brown Creeper was discovered in 1773 by the Forsters at Dusky Sound during Cook's second voyage. From G. Forster's drawing Latham drew up a description of the "New Zealand Titmouse" and Gmelin adopted this for the binomial name. The



Margaret A. Morison
BROWN CREEPER

species was next met with by Quoy and Gaimard at Tasman Bay during d'Urville's visit in 1827, and F. Strange collected it about 1850 and gave his specimen to Captain Stokes who forwarded it to the British Museum.

Adult. Top of head rufous brown; hind neck grey, tinged with brown; upper surface rufous brown, tinged with grey; quills dark brown, edged on the outer web with rufous and on the inner with yellowish white; tail pale rufous, crossed on the inner webs except the two central feathers, with a black band. Sides of head ash-grey; under surface rufous white. Iris black. Bill and feet pale brown, claws lighter. Bill 8-9, wing 62-67, tail 62-67, tarsus 21-22, mid toe 15 mm.

Eggs. Clutch two to four, pale pinkish, closely marked all over with light brown blotches and marks, coalescing all over and forming a zone at the larger end. 18.5 x 14, 19 x 14 mm. Dalys Bush. 17.4 x 14.2, 19.6 x 14.8 mm.

Distribution. South Island, D'Urville Island, Stewart Island, Codfish Island and other islands off Stewart Island. Fairly common in many localities. Inland Kaikouras. Akaroa (Sibson).

Ecology. The Brown Creeper occurs in forest and scrub from sea level to the upper alpine limit. It is found within the forest, usually high up on the trees, and also on the outskirts. In Stewart Island Guthrie-Smith observed it in March on the higher spurs of the hills and in the manuka above the bush line, while in October it was mostly found along the lower border of the forest and on the flats. It moves about in flocks which, according to Reischek, were sometimes accompanied by young saddlebacks. The Saddleback has disappeared from the South Island but the Brown Creeper, according to Mrs. Moncrieff, still has its followers for she has seen Silvereyes and Tomtits accompanying the flocks.

The Brown Creeper has, of course, been considerably reduced in numbers with the disappearance of large areas of forest. Against this contraction there has been a little expansion into the exotic pine forests. At Golden Downs it has been so reported. Like the Yellowhead and Whitehead the Brown Creeper suffers from the attention of the Long-tailed Cuckoo which destroys its broods in those nests it selects for its eggs.

Food. The food of the Brown Creeper consists, so far as is known, entirely of insects which it searches for on the branches and trunks of trees.

Voice. Andersen states that the flocks of Brown Creepers feed silently then suddenly break into song. The birds act in concert, all being silent at the same time and all singing together. According to Andersen, the song is composed of several distinct parts of which some are interchangeable

Nesting. The nest of the Brown Creeper has been but seldom found. Potts discovered one in December above the Rangitata Gorge. It was placed in a black beech tree about seven feet from the ground between the trunk and a spur that gave rise to a tuft of short branches. The nest was cup-shaped, wider at the base than at the rim and was composed of moss and vegetable fibres bound together with spiders' webs and lined with a few feathers. A nest recently found on Jacky Lee Island off Stewart Island is composed of herbaceous or rush stems, rootlets and moss and lined with weka feathers and some white ones. The laying period of the Brown Creeper is November and December. In Southland Philpott came across old birds feeding their young in February and so, he says, it is probable that two broods are reared in a season.

Lake Ohau *K. V. Bigwood*

BROWN CREEPER

References.—Gmelin, Syst. Nat., 1013, 1789 (*Parus novaeseelandiae,* Dusky Sound). Quoy and Gaimard, Voy. Astrol. Zool., 1, 210, col. pl. 1830 (*Parus zelandicus,* Tasman Bay). Gray, Zool. Erebus and Terror, Birds, 6, col. pl. from Forster, 1845. Buller, Birds N.Z., 105, 1872; 2nd ed., 1, 51, col. pl. 1888. Andersen, Bird Song, 78, 1926.

FAMILY MUSCICAPIDAE. FLYCATCHERS

Bill shorter than head, culmen ridged; slightly arched; nostrils exposed. Bristles at base of bill. First primary about half length of second.

Small insectivorous birds recognised by the rictal bristles, short first primary and booted tarsus.

Key to New Zealand Genera

Tail about equal to wing .... *Gerygone*
Tail shorter than wing.
  First primary short and narrow .... *Petroica*
  First primary longer and broader .... *Miro*

GENUS GERYGONE

Bill weak, shorter than head, the tip slightly downcurved and notched, nasal groove extending one third to one half the distance to tip. Fourth and fifth quills longest, second equal to secondaries. Tail about equal to wing.

Gerygone includes about sixteen species all of similar size and type of bill except the Chatham Island species which is larger and has a more compressed bill. It is accordingly referred to a subgenus equivalent to the remaining species.

The genus is found in Australia, New Guinea, New Caledonia and New Zealand. The New Zealand species are the common grey warbler of the main and near lying islands and the larger Chatham Island form.

Key to New Zealand Species

Nasal groove half culmen	*G. igata*
Nasal groove one-third culmen	*G. albofrontatus*

References.—Gould, Gray's Jour. Two Exp. Dic. Austr., 2, App. 417, 1841 (*Gerygone*, type *Psilopus olivaceus* Gould). Reichenew, Jour. f. Orn., 1908, p. 488 (*Hapolorhynchus*, type *Gerygone albofrontata* Gray). Sharpe, Notes Leyden Mus., 1, 29, 1879 (*Pseudogerygone*, type *Gerygone personata* Gould).

Grey Warbler. Riroriro

Gerygone igata

Though the Grey Warbler is abundant in all parts of New Zealand, it was not collected until the visit of the French zoologists Quoy and Gaimard in the *Astrolabe* in 1827. These naturalists collected their specimens at Tasman Bay and described the species under the name *Curruca igata*, the specific designation being a corruption of the reply given by the Maori when questioned as to its native name. Yate at the Bay of Islands in 1835 mentions the Riroriro, and specimens were obtained at Waikouaiti in the South Island about 1840 by P. Earl, and at the Bay of Islands by the naturalists of the *Erebus* and *Terror* in 1841.

Adult. Upper surface brownish grey, the back and rump tinged with olivaceous; quills dark brown, the outer margin yellowish; tail feathers dark brown on their basal, almost black in their apical portion, a white spot near the tip on all but the two central ones. Throat, foreneck and breast ashy grey; abdomen and under tail coverts white, the former slightly tinged with yellow. Bill and feet dark brown. Iris red. Bill 8, wing 53-56, tail 50-52, tarsus 18-19, mid toe 12-13 mm. *Immature.* Plumage generally paler, and yellow is absent on the abdomen. Iris brown.

Eggs. Clutch four, occasionally five or six, ovoid, pinkish white with band of reddish brown spots and blotches at larger end and scattered spots elsewhere. 15.5 x 11.8, 17.5 x 12.5 mm.

Status. The New Zealand Grey Warbler in its type of coloration resembles Australian species of the subgenus *Ethelornis.* Mathews and Iredale created for it the genus *Maorigerygone* on the grounds of the compressed bill, longer tail, fifth primary longest and different type of coloration. While it may be convenient to adopt the name *Maorigerygone* on the grounds of the compressed tion of the New Zealand species as a distinct genus is not justified. Ogilvie-Grant studied the New Zealand material in the British Museum in 1907 and recognised four species. These were reduced to subspecies by Mathews and Iredale six years later. But the differences given by Ogilvie-Grant are mainly concerned with depth of colour and have proved unsatisfactory for characterising species. Until further studies are carried out on an adequate series of specimens it is best to treat the Grey Warbler as a single species.

Distribution. Three Kings, North, South and Stewart Islands, Little and Great Barrier Islands, Hen and Chickens, Kapiti, Mayor Island, D'Urville Island, Chetwode Islands, Solanders, Codfish and other islands off Stewart Island. Plentiful almost everywhere.

Ecology. The Grey Warbler prefers scrub and forest margins, that is to say, open sunny situations, to the forest interior. Manuka

Lake Tekapo *K. V. Bigwood*

GREY WARBLERS

scrub is quite a favourite habitat. This species has been seen on Mount Egmont at an altitude of 5,000 feet. It is found in the exotic pine plantations on the Kaingaroa Plains and on the Golden Downs. Although it takes kindly to much of the new environment created by man especially where shrubs and trees grow, its numbers have been reduced considerably by the clearance of forest to make pastures. It is most often seen during the winter time when it comes into our gardens and orchards. Here no doubt the domestic cat takes a toll, but a more serious cause of loss appears to be interference with nests. Stidolph has described several cases but he cannot ascribe a cause. Then there is the Shining Cuckoo which destroys the second broods in many nests of the Grey Warbler.

Food. Constantly on the move this busy little species searches minutely every place likely to hide some small insect or spider. Its principal food consists of small insects and their larvae including the introduced aphids. On occasions the Grey Warbler hovers in the manner of a Humming Bird. Thus H. C. Abraham describes the catching of a spider by the bird hovering in front of the web for about half a minute. On Mount Arthur at an altitude of 3,000 feet I have seen a lacebark tree (*Hoheria glabrata*) swarming with Bellbirds, Tomtits and Grey Warblers. Two kinds of food, nectar and small insects would be present but I did not see a warbler sipping flowers. The Grey Warbler is a useful bird insofar as it consumes aphids and other insects in gardens and orchards.

Voice. The song of the Grey Warbler is a pleasant trill, sometimes in descending at other times alternating bars. It is subject to numerous variations for a description of many of which reference should be made to the writings of Andersen who has recorded them in musical notation. All who attentively listen to the trill of the Grey Warbler will notice that there are variations in the order and pitch of the bars in different localities.

Nesting. Two broods are usually reared each season, the first early in September and the second in October or November. Actually eggs are found as early as August and as late as January. The first brood is reared without interference but the second often comes to a disastrous end through the parasitic habits of the Shining Cuckoo. The Grey Warbler is a favourite victim of this species and, whether intentionally or merely through inconsideration, the young cuckoo generally either tramples on and kills or pushes out the young warblers which in any case have no chance of getting food while the cuckoo is in the nest.

The Grey Warbler's nest is generally placed on the outer small branches of a shrub or tree and from two to twenty-five feet above the ground. It is a pensile structure, usually more or less pear-shaped, though sometimes the bottom is rather extended. It is swung from a small branch or perhaps two by a base of about two inches and is besides securely stayed to several other branches within reach. It is thus fairly steady. The entrance is less than an inch in diameter and is situated near the top and generally overarched by a small porch. It is very compactly constructed of fine rootlets, moss, skeleton leaves, scales from tree ferns and spiders' webs, and lined with tree fern-scales and feathers. The nest is naturally built from above downwards and the work is usually carried out by the female. The male may be heard singing near at hand and occasionally may bring some nesting material but when he does the female builds it into the nest. The nest building of the Grey Warbler was watched closely by P. C. Bull who says that first a firm patch of material is woven round the suspension point. The sides are then built down all round and tapered inwards and joined at the bottom. The female then enters with lining material and by her movements increases the central cavity. The remainder of the nest building is done on the inside except for an occasional adjustment on the outside. The building time of the nest watched by Bull was seven days. As observed by J. M. Cunningham the incubation period was 17 to 19 days and the time the young were in the nest the same. The parents fed the young for three weeks after they had quitted the nest. The chicks were fed by both parents. When the young Warblers are displaced by a Shining Cuckoo then this villain is fed by the hard working Warblers. The Cuckoo may fill the nest and break it to pieces but the Warblers continue to feed it after it has left the nest. The whole process of feeding the Cuckoo which has displaced the Warbler's own chicks is a remarkable and peculiar instinct but apparently as firmly fixed in the life of the Warbler as the rearing of its own young.

Maori. Mention of the Riroriro occurs in many stories, songs and proverbs of the Maori. When the Riroriro begins to sing is the time to begin planting and the proverb "Where were you when the Riroriro began to sing?" is applied to a lazy man who has neglected his work. It is said that the weather for the coming summer can be predicted by noting the direction in which the Grey Warbler faces its nest.

References.—Quoy and Gaimard, Voy. Astrol. Zool., 1, 201, 1830 (*Curruca igata,* Tasman Bay). Gray, Zool. Erebus and Terror, Birds, 3, 1844 (*Psilopus igata, P. flaviventris,* col. pl.). Buller, Birds N.Z., 107, col. pl. 1872; 2nd ed., 1, pp. 44, 50 (*G. flaviventris,* col. pl., *G. sylvestris*). Grant, Ibis, 1905, p. 587; 1907, p. 542 (four species). Andersen, Bird Song, 48, 1926. Guthrie-Smith, Birds, Water, Wood, Waste, 142, 1910. Stidolph, Emu, 39, 84, 1939. Wilkinson, Kapiti Bird Sanct., 51, 1952.

Chatham Island Warbler

Gerygone (*Hapolorhynchus*) *albofrontata*

Dr. Dieffenbach during his visit to the Chatham Islands was the first to collect this species. His specimens were forwarded to the British Museum and used by Gray to describe the species, the name *albofrontata* having reference to the white forehead. The species is quite common and was obtained by Travers in 1871, and by several subsequent collectors.

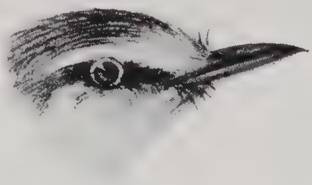
Adult. Forehead and line over eyes white; upper surface olivaceous brown; upper tail coverts rufous brown; quills brown, narrowly edged with olivaceous; basal part of tail rufous brown, followed by a brownish black band and, on the three outer feathers, a pale rufous patch, tips brown. Line through eye brown; under surface white tinged with yellow on the flanks and lower abdomen. Bill and feet dark brown. Iris red. Bill 11-12.5, wing 56-65, tail 52-56, tarsus 21-22, mid toe 15-16.5 mm. *Immature.* Distinguishable by the dusky yellowish white under surface.

Eggs. Clutch four, ovoid, pinkish with reddish brown blotches and spots all over and forming a zone at the larger end. 17.5 x 13, 18.5 x 13.5, 19.4 x 13.6 mm.

Status. The Chatham Island Warbler differs from all the other species of *Gerygone* in the larger and more compressed bill and to express this difference it seems to me proper to treat it as belonging to a separate subgenus.

Distribution. Chatham Islands. Wharekauri, South East Island, Little Mangere. Everywhere plentiful, especially in the southern part of Wharekauri.

Habits. Archey and Lindsay, who visited the Chathams in 1923, give the following particulars about this Warbler: "It is by far the commonest native bush bird on the Chatham Islands, and perhaps the tamest. In the north they are only moderately abundant, but in the south they were constantly around us, particularly on the scrub country of the plateau. The residents call them 'wood-peckers,' suggestive of their busy tip-tipping along the twigs and branches in their



Margaret A. Morison

CHATHAM ISLAND
WARBLER

South East Island *C. A. Fleming*
CHATHAM ISLAND WARBLER

search for insects. They were not, however, much given to song, and the best we heard was but a faint trill of four notes."

The nest of the Chatham Island Warbler is a covered pendant structure with the entrance at the side near the top and overarched by a projecting piece. A nest from Te Whakuru was made from fern roots, moss, leaves and cobwebs and lined with feathers. Fleming found the nesting well under way in November and young were seen the following month. Family parties including three or four young were seen about until the end of January. The Chatham Island Warbler is parasitized by the Shining Cuckoo which, however, visits the group in small numbers only. The Cuckoo arrives in October and leaves in January.

References.—Gray, Zool. *Erebus* and *Terror*, Birds, 5, col. pl. 1845 (*Gerygone albofrontata*). Buller, Birds N.Z., 111, 1872; 2nd ed., 1, 49. 1888; Suppl., 2, 119, col. pl. 1905. Fleming, Emu, 38, 505, 1939.

Genus Petroica

Bill much shorter than head, broad at base; upper mandible notched near tip. First quill very small, second longer than secondaries, fourth and fifth longest. Tail shorter than wing. Tarsus booted.

Distinguished from Miro by its smaller size and by the relatively smaller and narrower first primary. Females differ from males in the plumage being duller or having the under surface below the chest white or yellowish. There are several species in Australia and the western Pacific besides the three in New Zealand.

According to the colour of the under surface the New Zealand members of this genus fall into three groups and as one of these groups has three forms, two grades, species and subspecies, are necessary to express the relationship. These interesting colour combinations have been fully described by Fleming.

Key to Species and Subspecies

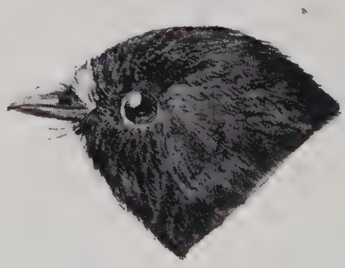
Breast and abdomen white	*P. toitoi*
Breast and abdomen yellow.	
Female with upper surface fuscous	*P. macr. macrocephala*
Female with upper surface sepia	*P. macr. chathamensis*
Female with upper surface dull black	*P. macr. marrineri*
Breast and abdomen black	*P. dannefaerdi*

References.—Swainson, Zool., Ill, 1, 39, 1829 (*Petroica* type *Muscicapa multicolor* Gmel.). Reichenbach, Syst. Av., 1850, pl. 67 (*Myiomoira*, type *Muscicapa toitoi* Lesson). Fleming, Trans. Roy. Soc. N.Z., 78, 14, 1950.

White-breasted Tomtit. Pied Tit Miromiro.

Petroica toitoi

In 1824 the French corvette *Coquille* visited the Bay of Islands with d'Urville and Lesson, two ardent naturalists, on board. Among the discoveries made on this occasion



E. H. Atkinson
WHITE-BREASTED
TOMTIT

was the White-breasted Tit, specimens of which were first described by Lesson who based his specific name on one of the Maori names. It was mentioned by Yate in 1835 as inhabiting the Bay of Islands, as nesting in holes in trees, while Earl about 1840 obtained and forwarded specimens to the British Museum. "It is very common," says Earl, "at Port Nicholson, flying about the gardens near the homes."

Adult Male. A white spot over the bill; head, neck and upper surface glossy black; quills brownish black with a broad white band across the secondaries and a few white patches on the primaries; tail black, the three outer feathers on each side crossed obliquely by a broad white band. Breast and abdomen white. Bill brownish black, yellow at base of lower mandible, inside of mouth yellow. Iris black. Feet brownish, toes brownish yellow, claws black, soles orange yellow. Bill 9.5-12, wing 65-75, tail 47-55, tarsus 18-22.5, mid toe 17-19 mm. *Adult Female.* Frontal spot olive buff; lores, cheeks and ear coverts brownish olive mottled with olive buff; upper surface brown; a fulvous white bar across the secondaries and some spots on the primaries; tail black, the three outer feathers on each side barred obliquely with white. Under surface greyish white clouded with brown. *Immature Male.* Frontal spot small; head, except throat, brownish black with fuscous shaft streaks; remainder of upper surface brownish black with obscure shaft streaks on the back; wings and tail as in adult. Throat black, the feathers with white shafts and tips giving a mottled appearance; upper breast cream with hair brown tips and pepperings forming an indistinct band; lower breast white with faint pepperings. *Immature Female.* Frontal spot very small; dorsal plumage warmer than in adult with buff shaft streaks from crown to rump; throat and breast washed with hair brown, tips of feathers buff, forming an indefinite band.

Colour Varieties. A pure white bird, except for a grey patch on one of the primaries, was taken at Paraekaretu in the Rangitikei district, and another with a few brown feathers was taken at the Upper Hutt. Partial albinos have been obtained from Wanganui, Otaki and the Upper Hutt. All albinos or partial albinos so far recorded have been from the western part of the Province of Wellington.

Kapiti Island *A. S. Wilkinson*

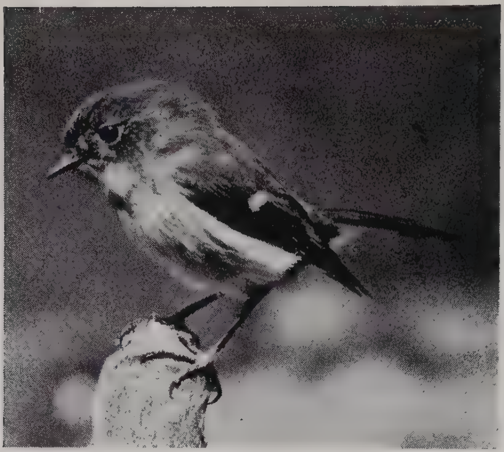
WHITE-BREASTED TOMTIT, MALE

Eggs. Clutch three or four, broadly ovoido-conical, creamy white, freckled all over with yellowish brown and forming a zone at the larger end, 18 x 16 mm. Kapiti. 17 x 14, 18 x 14 mm. Rotoiti.

Status. Distinguished by its small size and absence of yellowish colouring.

Distribution. North Island and adjacent islands: Mokohinau, Hen and Chickens, Little Barrier, Great Barrier, Kapiti. Rare to the north of Auckland, a few in Waipoua forest and the Waitakere Ranges. Bay of Islands, not recorded since 1899. South of Auckland in forest and scrub: Hunua Range, Coromandel Peninsula, Rangitoto Range, Tauranga to Taupo and Lake Waikaremoana. Mount Egmont. Ruapehu, Kaimanawa, Ruahine and Tararua Ranges, and other large areas of forest. Wairarapa Plains, rare.

Habitat. The White-breasted Tomtit is, like its southern relative, a forest bird, frequenting alike the lowland rimu forest and the upland beech forests. It is much in evi-



Kapiti Island *A. S. Wilkinson*

WHITE-BREASTED TOMTIT, FEMALE

dence in forest clearings and manuka scrub and extends its range out into the settled districts. In 1840 it was widely distributed but now its numbers are much reduced through the replacement of forest and scrub by farmlands. It has, however, invaded the exotic pine forest at Atiamuri and the Kaingaroa Plains.

Food The food of the White-breasted Tomtit consists mainly of insects which it seeks on the lower parts of trees and on the ground. It seems never to be still and when momentarily perched on a twig or bole of a tree is quick to espy any insect that may be in sight. Quickly it darts to the ground to seize its prey and flies off to some perch to devour it. Sometimes insects are taken on the wing. M'Lean once watched a struggle between a Pied Tit and a large Puriri moth (*Charagia*). Both tumbled about on the ground until the bird killed its victim.

The White-breasted Tomtit must be accounted a useful species as it frequents gardens and plantations and feeds on insects. It is a diligent searcher on trees and dug ground, and must consume large numbers of moths, grubs and beetles.

Voice. Mrs. Amy Wilkinson describes the note of the male Tomtit on Kapiti Island as a "cheery little song or whistle which he repeats without much variation at frequent intervals, chiefly in the spring time. . . . The female may very occasionally be heard singing the same short song, but in so low and subdued a tone as to be almost inaudible. . . . The call notes of both birds are, at times, surprisingly loud and piercing, and repeated rapidly, with widely open mouth, three or four times in succession. When nest building is in progress the birds keep in touch with one another with similar notes, but not nearly so loudly uttered and using them but singly, one calling and the other answering until they come together."

M'Lean says that the penetrating call of the male Tomtit in the East Cape district "may be heard fairly frequently throughout the day during autumn and winter. It consists of one note 'see' repeated deliberately though rapidly three times."

Nesting. A delightful account of the nesting of the North Island Tomtit on Kapiti Island, written by Mrs. Amy Wilkinson, was published in the *Emu* in 1930. The following extracts are from her article: "The same pair of Tomtits apparently stays about the same area all their lives. The birds resent the presence of another of their kind within their fenceless domain, the male fiercely chasing the trespasser, and causing him to take hurriedly the shortest cut for home. The range of their territory is quite extensive for small birds, maybe ten or more acres. . . . Nesting operations begin rather early in the season, sometimes during the last week in August. Often a hole in a tree is chosen, sometimes a sheltered cleft in a bank or rock, and sometimes they build their cosy nest in the branches of a tree, generally choosing a low and compact one. The nest is, I believe, built entirely by the female, the male supplying her with food while she works. He helps her to select the site. . . . The material used for the construction of the nest is composed principally of moss and soft scraps of thin bark bound together with cobwebs, and lined softly inside with feathers. . . . The hen bird does most, or probably all the incubating, sitting on the egg for about 17 days. She leaves them frequently in response to a call from her mate at intervals of about a quarter of an hour, when he carries food for her. She generally flies to a neighbouring tree to receive it from him. . . . He puts the food —an insect of some kind—into her mouth, she fluttering her wings in the manner of young birds when being fed.

"When the young are hatched both parents carry food and occasionally the male will give his catch to the female to feed to them. . . . Young tomtits stay in the nest until about 17 or 18 days old. After they leave . . . they are still fed very frequently by their parents. . . . After helping her mate to attend to the wants of the growing family for about ten days, the hen Tomtit begins to build again, and leaves the work of feeding almost entirely to the cock bird. . . . The male feeds the young another week or two, giving them less and less attention, and by this time they can catch a certain amount for themselves. . . . By the time the second brood is reared, which may be well into February, the adult Tomtits are beginning to moult and go into retirement, the young following them, but instead of food they receive chastisement, the father bird being particularly fierce with them. A noticeable feature in connection with the rearing of the broods is the way the young at times are separated, each parent taking their share of the family to mind, and it seems to be the most usual thing for the mother bird to provide for the little hens, and the father for the young cock birds." According to Guthrie-Smith's observations the male feeds the female before sitting begins.

References.—Lesson, Man. Orn., 1, 188, 1828 (*Muscicapa toitoi*, Bay of Islands). Garnot, Voy. Coquille Zool., 590, col. pl. 1828. Reischek, Trans. N.Z. Inst., 19, 184, 1887. Buller, Birds N.Z., 124, 1872; 2nd ed., 1, 39, col. pl. 1888. M'Lean, Emu, 11, 72, 1911. Wilkinson, A. S., Emu, 26, 239, 1927. Wilkinson, Amy, Emu, 30, 102, 1930. Fleming, Trans. Roy. Soc. N.Z., 78, 33, 1950. Parkin, Notornis, 4, 162, 1951. Wilkinson, Kapiti Bird Sanct. 52, 1952.

Yellow-breasted Tomtit. Ngiru-ngiru

Petroica macrocephala macrocephala

This friendly little species was discovered by Forster at Queen Charlotte Sound during Cook's second voyage. Latham, when describing Banks' collection, called it the Great-headed Tit, hence the specific name adopted by Gmelin. It was again collected at Queen Charlotte Sound by Ellis in 1777 during Cook's third voyage It appears in J. G. Black's list of the birds of Stewart Island, 1872.

Adult Male. A white spot over the bill; head and upper surface glossy black; wing coverts black with white tips on a few secondary major coverts; quills blackish brown with a broad white band across the secondaries and a narrow white band across the primaries and at right angles to the broad band; tail black, the three outer feathers on each side crossed obliquely by a broad white band. Breast and abdomen pale lemon-yellow, deepening to orange on the upper breast and becoming paler on the lower abdomen. According to Stead the orange on the breast increases in richness with the age of the bird. Bill brownish black. Iris dark brown. Feet dark brown, soles yellow. Bill 9-12, wing 67-75, tail 52-59, tarsus 20-25, mid toe 15-20 mm. *Adult Female.* Olive buff spot over bill; upper surface fuscous; some rump feathers with dark olive buff tips; quills blackish brown, alar bar as in male but buff on outer webs and whitish on inner webs; upper wing coverts blackish brown; tail blackish brown with oblique bar as in males. Lores, cheeks and ear coverts brownish olive mottled with olive buff; under surface maize yellow; under tail coverts buff. *Immature Male.* Frontal spot smaller than in adult; upper surface crown to rump brownish black with buff shaft lines; upper tail coverts with buffy tips; wing and tail as in adult. Throat brownish black with pale feather shafts; breast ill defined from neck, buff grading ventrally into maize yellow, white at venter. *Immature Female.* Similar to adult female but with conspicuous light shaft areas on fuscous feathers of crown and nape. Frontal spot almost absent. Cheeks fuscous mottled with light central areas to the feathers; throat mottled fuscous and buff; breast light buff washed and mottled with drab and buffy brown; abdomen light buff. *Colour Varieties.* Buller shot on Stewart Island, but did not recover, an albino Tomtit, and there are partial albinos from Nelson and Puerua (Otago). A specimen from Otago in the Canterbury Museum has the breast salmon above passing backward into light ochraceous salmon. The inner web of the third tail feather from the outside may be white or black at the tip.

Eggs. Clutch three or four, ovoid, white with small light brown and grey spots and blotches all over and in a dense band at the larger end. 17.6 x 14.2, 17.8 x 14.4, 18.2 x 14.8 mm.

Status. Nearest to *P. m. toitoi,* agreeing in proportions, female dorsal colour and plumage pattern, differing in its larger size and presence of yellow on the under surface. Yellow on the under surface is present in *P. m. chathamensis* and *P. m. marrineri* as well as in *P. m. macrocephala.*

Distribution. South Island and offlying islands: D'Urville, Chetwode, Solander, Stewart and Codfish Islands. All through the South Island where there are considerable areas of forest. Some recent records are: Marlborough Sounds, Kaikoura, Dun Mountain, St. Arnaud Range, Ashley Gorge, Banks Peninsula, Lewis Pass, Paparoa Range, Waiho, Mt. Cargill, Catlins, Dart Valley, Homer; Milford, Caswell, Doubtful and Dusky Sounds.

Ecology. The Yellow-breasted Tit is a bird of the forest, both of the interior and the outskirts, and also of the more open scrub. It is equally common in rimu forests at sea level as it is in beech forest at 4,000 feet altitude and even in the scrub above the forest line. A seasonal migration to the coast in spring and inland in autumn was observed by Guthrie-Smith in Stewart Island. The cultivated districts are frequented more especially after the breeding season. Pine plantations at Golden Downs and Waipori have been invaded by Yellow-breasted Tomtits, yet the advance of European settlement has resulted in a considerable reduction in their numbers since 1840. Introduced birds, too, for example, starlings, by destroying Tomtits' nests have helped in this process.

Food. The food consists principally of insects and their larvae; but millipedes, spiders and earthworms are as greedily eaten, sometimes flies are caught on the wing. This Tomtit searches diligently the bark on the trunks of trees and in fact every place likely to harbour insects. It has been seen on ground that has been ploughed and in orchards so that it is an entirely useful bird to the agriculturalist.

Nesting. Various sites are chosen by the Yellow-breasted Tomtit for its nest. Common situations are under the head of cabbage trees, among partly loosened bark on the trunks of trees, in holes left by fallen branches, or under a bank or leaning tree. The nest is compactly constructed of moss, roots, leaves, tree-fern scales and spider webs, and is lined with tree-fern scales and moss, or grass and feathers. It is variously shaped to fit the position in which it is placed, the base supporting the cup in one instance being about sixteen inches high. The male bird feeds the hen while nest-building as well as during the period of incubation, and so far as has been observed the hen alone builds the nest, though N. J. Jensen reports that the male sits on the eggs for a quarter to half an hour or so at a time.

The following records are of interest as giving dates of laying and period of incubation. (1) Half Moon Bay, Stewart Island, recorded by N. J. Jensen; October 8th, 1939, started to build, took four days; Oct. 19th, started sitting; Nov. 3rd, hatched; Dec. 22nd, young flew; four eggs, all hatched. Nest made of moss, hair and feathers. Female did most of the sitting, fed by the male. Male stayed only for quarter to half hour or so. Young first fed on what looked like crane-flies, later on small grubs. (2) In Canterbury Potts quotes the following dates: Nest begun Nov. 1, first egg Nov. 10, fourth egg Nov. 13, young hatched Nov. 29th. These two records give the period of incubation as fifteen and sixteen days. According to Stead, two broods may be reared in quick succession. He states for instance that the day after the young left the nest the hen bird was busy building another nest while the cock fed the young. In order to lead intruders away from its nest, the Yellow-breasted Tomtit has been seen to feign lameness, a habit more common to ground-breeding birds such as stilts, plovers and ducks.

References.—Gmelin, Syst. Nat., 1, 103, 1789 (*Parus macrocephalus,* Queen Charlotte Sound). Gray, Zool. Erebus and Terror, Birds, 6, col. pl. 1845 (*P. macrocephala, P. dieffenbachii*). Buller, Birds N.Z., 126, 1872; 2nd ed., 1, 42, col. pl. 1888. Potts, N.Z. Jour. Sci., 2, 286, 1884. Andersen, Bird Song, 60, 1926. Guthrie-Smith, Mutton Birds, 187, 1914. Fleming, Trans. Roy. Soc. N.Z., 78, 28, 1950.

Chatham Island Tomtit

Petroica macrocephala chathamensis

The Chatham Island Tomtit was discovered by Dieffenbach on his visit to the group in 1840. Buller collected specimens in 1855 and Travers brought one back from Pitt Island in 1871. Gray founded the name *dieffenbachi* for the Chatham Island Tomtit but, possibly by mistake, a South Island bird was selected as type. This put Gray's name into synonymy and so Fleming founded a new name, *chathamensis.* To have changed the type would have avoided changing the name but perhaps the rules do not allow this.

Adult Male. Similar to *P. m. macrocephala* but differs in slightly larger size longer tarsus, and in third tail feather from the outside not having the white of the inner web extending to the tip. As in *toitoi* and *macrocephala* only the three outer rectrices on either side have white patches. Bill 10-12, wing 71-78, tail 54-60, tarsus 23-27, mid toe 18-22 mm. *Adult Female.* Upper surface sepia, warmer in tone than in the female of *macrocephala* and *toitoi*; frontal spot larger, bordered above by a black line; under surface cream without a buffy wash. *Immature Male.* Upper surface, including lores and sides of face, to upper tail coverts, dull brownish black, the feathers with light fuscous shafts; frontal spot small; throat fuscous, remainder of under surface white; wings and tail as in adult. *Immature Female.* Similar to adult female but upper surface with light buff shafts; throat white peppered with brown, rest of under surface white washed with buff, and flecked with drab on flanks and breast; thighs and under tail coverts pinkish buff. *Colour Varieties.* Fleming states that a number of females tend toward maleness in having the throat and sides of head mottled with brownish black, and he describes two in which these parts are altogether that colour. The males, according to Fleming, showed a gradation of colour on the upper breast from pale lemon yellow to rich salmon pink.

Distribution. Chatham Island, formerly abundant everywhere, now confined to the southern portion; Pitt Island, Mangere, Little Mangere. South-east Island.

Habits. The absence of Tomtits in the northern portion of Chatham Island is said by Archey and Lindsay to be due to the lack of undergrowth which is there regularly destroyed by grazing stock. Fleming says: "In late December most pairs were with well grown young in family parties showing broods of two to four, but some pairs appeared to be still nesting."

References.—Fleming, Emu, 38, 506, 1939; Trans. Roy. Soc. N.Z., 78, 36, 1950 (*P. m. chathamensis,* South-East Island).

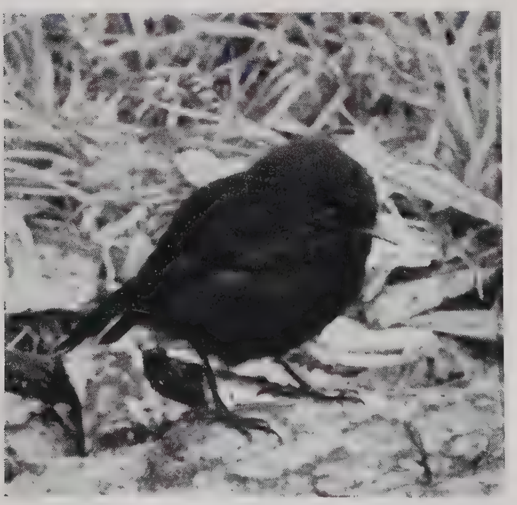
Auckland Island Tomit

Petroica macrocephala marrineri

On the visit of the British Antarctic Expedition to the Auckland Islands in 1839, the surgeon in the *Terror,* McCormick, collected a tomtit which he gave to the British Museum. Reischek noticed it at Carnley Harbour in 1888, and in 1901 and 1902 Lord

Ranfurly collected a series of specimens for the British Museum.

Adult Male. Similar to *P. m. macrocephala;* white frontal spot small; breast maize yellow; feathers of lower flanks with subterminal grey bands; under tail coverts black with faint whitish tips; tail with variable white bar on four outer rectrices. Bill 11-12, wing 74-81, tail 58-64, tarsus 24-26.5, mid toe 18-23 mm. *Adult Female.* Similar to male but upper parts dull black or blackish brown; upper tail coverts with buff tips; throat black, darker than upper surface; breast and abdomen white to ivory. *Immature Male.* Differs from adult in having faint light shaft lines on head and minute fuscous tips to feathers from crown to scapulars; breast maize yellow peppered with blackish along the upper edge. *Immature Female.* Upper surface dull blackish brown with light shafts; lores and neck black with lighter centres to the feathers; breast ivory with deep grey tips to the feathers; line between neck and breast ill defined; tail with white spot on fourth rectrice from outside present in about half of the birds. *Colour Variety.* Guthrie-Smith records an Auckland Island Tomtit with pale carmine instead of yellow on the breast.



SNARES ISLAND TOMTIT
Snares Islands *L. E. Richdale*

Status. Differs from all the other subspecies in the female plumage resembling the male, that is, in its black upper surface and head, black under tail coverts, black secondary coverts, and the pattern of white on the tail.

Distribution. Auckland Islands; littoral forest from sea level to about 500 feet; Auckland Island, Adams Island, Ocean, Rose, Ewing and Enderby Islands. (Fleming).

References.—Mathews and Iredale, Ibis, 1913, p. 436 (*Myiomoira macrocephala marrineri,* Aucklands). Fleming, Trans. Roy. Soc. N.Z., 78, 40, 1950.

Snares Island Tomtit

Petroica dannefaerdi

When Reischek visited the southern islands in 1888 he landed at the Snares and captured, by running down, a black tomtit. This was the first specimen of this species collected and it was thought to be the same species as the Chatham Island Robin. Some six years later, Dannefaerd collected a series and forwarded them to Rothschild, who characterised the species as new, naming it after its collector.

Adult Male. Glossy black, bases of feathers grey with light shafts; wing and tail brownish black. *Adult Female* similar but less gloss. Bill 11.5-13, wing 76-83, tail 62-66, tarsus 26-27, mid toe 20-22.5 mm. *Immature.* Dull black, feathers of crown, throat and breast with pale grey shafts; ventral flank feathers with fuscous tips.

Eggs. Clutch three, broadly ovoid, white with small brown and grey spots, sometimes covering the whole surface but always more thickly disposed at the larger end. 18.5 x 14.5, 20 x 16, 21.5 x 15 mm.

Status. Of the pied forms this Black Tomtit approaches most nearly *P. m. marrineri.* Fleming includes it as one of the subspecies of *P. macrocephala,* remarking that, apart from its melanism, there is little to separate it from *marrineri.* For the reasons given in the introductory chapters I am accepting the division between the pied and the black tomtits as of specific value.

Distribution. Snares Islands; common.

Habits. The Snares Tomtit is found in the tussock grass, scrub and *Olearia lyallii* forest that cover the island. It is common in all these plant formations, especially in the coastal scrub where sea lions and penguins abound. Here it can obtain maggots which are plentiful in the breeding colonies of these animals. According to Stead the chief food is white maggots from the ground, but the birds assiduously hunt the top growth of the olearias for caterpillars. They also hawk small moths in the air.

Nesting. A detailed account of the nesting habits of the Snares Tomtit has been published by E. F. Stead and from it the following description is quoted: "During site hunting and nest building the hen is fed by her mate, but she carries all the material and does the building. (Falla once saw the cock bird also carrying material.) First she laid down a little circle of bits of dry moss, mixed with fern scales and a few leaves of grass. . . . Gradually building this up, she carefully bonded it with tiny rootlets, fibres and cobwebs. . . . The centre of the nest was composed chiefly of fern scales and a few light coloured petrel feathers. . . . She began building on November 26 and the nest was completed by the evening of December 1. . . . Early in the morning of December 4 I found an egg in it. She missed the 5th and laid her second egg early on December 6, the day we left the island. Some nests had all light coloured feathers, others darker, and one all black. Without exception they contained three eggs or young. Most of them were exceedingly well hidden in hollow logs or holes in trees. All around the perimeter of the island tits were nesting just over the edge of the cliffs on ledges or among vegetation. In the bush the nests were all less than four feet from the ground, and one was actually on the ground, at the foot of a big sloping tree. All were very well protected from rain.

"The cock bird feeds the hen while she is incubating, flying with a bill full of food to a perch which may sometimes be thirty yards or more from the nest, and calling her off. In a crouching attitude, and with wings fluttering, she receives the food and immediately returns to the nest. . . . When the young are small the cock calls the hen off the nest to a nearby perch for her food, and also feeds the young at the nest, the hen standing aside while he gives the food to the young."

References.—Rothschild, Nov. Zool., 1, 688, 1894 (*Miro dannefaerdi*). Buller, Suppl. Birds N.Z., 2, 125, 1905. Stead, N.Z. Bird Notes, 3, 7, 1948. Fleming, Trans. Roy. Soc. N.Z., 78, 44, 1950.

GENUS MIRO

Bill stout, culmen ridged, upper mandible notched near tip. Second quill equal to secondaries; fourth and fifth longest. Tail shorter than wing. Tarsus strong, booted.

Related to Petroica but larger birds and with a relatively longer and broader first primary. Two species confined to the New Zealand region.

Key to Subspecies

- White or yellowish on under surface.
  - Upper surface dark slaty grey with whitish shaft lines, North Id. .... *M. a. longipes*
  - Upper surface sooty grey.
    - No whitish shaft lines .... *M. a. australis*
    - Faint whitish shaft lines. Stewart Id. .... *M. a. rakiura*
- Entirely brownish black .... *M. traversi*

Reference.—Lesson, Traite Orn., 389, 1830 (*Miro,* type *Muscicapa longipes* Less.).

North Island Robin. Toutouwai
Miro australis longipes

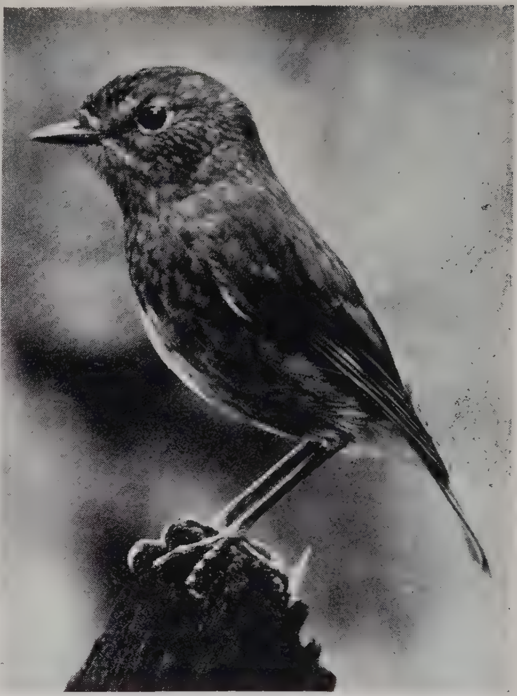
This species was one of the discoveries made by Lesson when he visited the Bay of Islands in 1824 in the French surveying corvette *Coquille* under the command of Captain Duperrey. Lesson stated that it occurred in the brushwood surrounding the Bay of Islands and that his specimen was shot near the Maori village of Kaouera. It was mentioned by Yate at the Bay of Islands in 1835, and was collected in the same locality in 1841 by the British Antarctic Expedition under Sir James Ross.

Adult Male. A white spot over the bill; upper surface dark slaty grey with greyish white shaft lines; quills blackish brown with an oblique white bar of triangular spots on the inner webs; tail blackish brown. Throat, foreneck and sides of body slaty grey mottled with white due to a narrow white edging to the shafts; lower breast, middle of abdomen and under tail coverts white, irregularly defined. Bill blackish brown. Iris black. Feet pale yellowish brown, soles yellow. Bill 16-17, wing 87-95, tail 60-68, tarsus 34-38, mid toe 24-26 mm. *Adult Female.* Plumage browner and paler than in the male; lower breast and abdomen creamy white, not sharply marked off from upper breast and sides of body. *Immature* similar to adult female.

Eggs. Clutch two, sometimes three, ovoid, creamy white, spotted all over with purplish brown, denser at the larger end, 23 x 19, 23 x 17 mm. Kapiti.

Status. Differs from the South Island Robin in its smaller size, white shafts on upper surface and mottling on throat and upper breast, and the white lower breast and abdomen. It resembles the female of the South Island species more than it does the male.

Distribution. Formerly common throughout the North Island including Great Barrier and Mayor Islands. Now found in the following districts: Little Barrier Island, Rangitoto Range. Central plateau from Mamaku to Mount Ruapehu and westward to the Upper Wanganui. Raukumara, Huiarau, Kaweka, Kaimanawa, Ruahine and Tararua Ranges. Kapiti Island. Not common anywhere except on the island sanctuaries of Little Barrier and Kapiti.



Kapiti Island *Amy Wilkinson*

NORTH ISLAND ROBIN

Ecology. The North Island Robin is now found mainly in the interior of dense forests, preferring the lower part and the forest floor. It is no more to be seen in glades and tall manuka shrub as recorded by Guthrie-Smith in the Poverty Bay district. It is not often seen near European settlements though it may frequent the vicinity of saw mills, and it comes close to the motor highway near Mamaku. It has also, strange to say, invaded in small numbers the exotic pine forests of the Kaingaroa Plains. In general the Robin has been extremely sensitive to the conditions created by European settlement and consequently has disappeared entirely from very large areas in the North Island. Probably this rapid and wholesale clearance has been due mainly to introduced rats and cats, as the bird's confiding nature makes it an easy victim of any predatory animals. Although the disappearance of the Robin has kept pace with the clearing of the forests there is some evidence to show that the decline began before the forest was actually cut down. Guthrie-Smith, for instance, said that it disappeared in the Tutira district before the forest was cleared, and Elsdon Best, writing in 1909, in the forested Urewera country, said that Robins had practically disappeared from there many years before. This may be due to rats invading the forest ahead of European settlement.

Food. The food of the North Island Robin is mostly taken on the ground and consists mainly of insects, spiders and worms. It has also been observed, by Wilkinson on Kapiti Island, eating the pulp of karaka berries. Whenever a halt is made in the forest an opportunity is afforded for observing this bird. It turns over dead leaves on the forest floor, searching for whatever forms of life may be there and takes little or no interest in the human intruder. In fact it soon comes to familiar terms if encouraged with a few crumbs from one's lunch.

Voice. The song of the North Island Robin has been compared with that of the thrush, canary and English robin. Though the bird usually frequents the forest floor, it may deliver its song from the topmost branches of some lofty tree. The song is loud and clear and consists of a great variety of notes, and is sometimes sustained as long as half an hour. It is rarely heard during the winter but mostly in the spring, especially during the early part of the day.

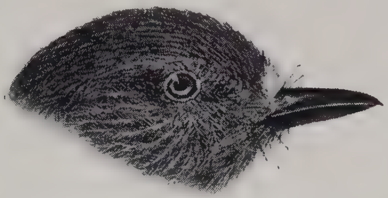
Nesting. For a brief account of the breeding habits of the North Island Robin I cannot do better than summarise the information supplied to me by Mr. A. S. Wilkinson of Kapiti Island. A variety of sites is chosen—in hollow trees, against banks, on rocks, against boles of trees or roots, amongst kiekie and rata vines, and under clusters of the climbing fern *Blechnum filiforme.* The nest is neatly constructed of small twigs, leaves, moss, strips of nikau and kiekie, fastened together with spider webs and lined with tree-fern scales, grass and rootlets. The breeding season extends from October to February and all the nest-building and incubation is carried out by the female.

Stidolph writes of Robins on Kapiti Island: "Having arrived at a distance of twenty feet or so from the nest he gives a call note and the hen immediately leaves the nest to be fed. She alights alongside her mate, who satisfies her hunger to the accompaniment of much joyous twittering. Before she returns to her task she may give a hasty glance round to see if any food is to be picked up, but Mr. Robin provides her with the great bulk of her sustenance."

On Little Barrier Island, Guthrie-Smith found a number of nests. Any flat surface or shelf, or gently inclined plane with a back to it is, according to that observer, favourably considered by the Robin. One nest was placed on a flat projecting kohekohe bole shaded by tree-fern leaves; a second was on the split portion of a broken branch of a kohekohe; a third was built on a kind of shelf formed by an accumulation of midribs of tree-fern leaves. The materials used consisted of small twigs, leaves, scraps of bark, rootlets, lichens, moss and the living rhizomes of Polypodium arranged so that the leaves lay flat as if clinging naturally. Tree-fern scales alone formed the lining. "The edges of all Robins' nests," states Guthrie-Smith, "are beaten hard by the outstretched wings of the female, and firmly netted with spider web. . . . Two or three times an hour during the progress of incubation the hen is called off into some convenient greenery, there to receive the offerings of the male, who, after feeding her, mounts high on a neighbouring tree and sings delightedly." The months for laying are October to December.

As in the case of Tomtits the male brings food to the female during the period of nest building. On the subject of the Robin's efforts to district attention of visitors to the vicinity of the nest M'Lean says of the Robin in the Maungahaumia district, Poverty Bay: "It is a jealous bird and assails any of its own or of other species that trespass in its domain. At the nest the greatest anxiety is displayed, while the female by fluttering to the ground and feigning a broken wing does her best to lead the intruder from the spot, and has even been known to attack and peck his hand." The period of incubation was determined by Parkin on Little Barrier Island to be 14 days but it might have been 16 days or even more. The period from hatching to leaving the nest was 19 days.

References.—Lesson, Man. Orn., 1, 248, 1828 (*Muscicapa longipes,* Bay of Islands). Garnot, Voy. Coquille Zool., 594, col. pl. 1828. Buller, Birds N.Z., 119, 1872; 2nd ed., 1, 33, col. pl. 1888. Reischek, Trans. N.Z. Inst., 19, 183, 1887. M'Lean, Emu, 11, 68, 1911. Guthrie-Smith, Bird Life, 63, 1925. Wilkinson, Emu, 26, 240, 1927; Kapiti Bird Sanct. 55, 1952. Fleming, N.Z. Bird Notes, 2, 24, 1946. Buddle, Bird Secrets, 15, 1951.



Margaret A. Morison
SOUTH ISLAND ROBIN

South Island Robin. Toutouwai

Miro australis australis

During Captain Cook's sojourn at Dusky Sound in 1773, the South Island Robin was collected by both Sparrman and Forster. Each described it, Sparrman's account first appearing, while a third name founded on Forster's specimens was given by Gmelin. Forster recorded that it fed on insects and minute crabs on the sea shore and also obtained insects in the scrub. He also remarked that it was quite fearless and sang sweetly. After Forster's visit, nothing was recorded of this species until the investigations of Haast, Buller and Potts began eighty to ninety years later.

Adult Male. A white spot over the bill; head, neck, sides of body dark sooty grey; quills and tail feathers smoky black. Breast, abdomen and lower tail coverts yellowish white, tinged with lemon-yellow on the breast; a white bar across the under surface of the quills. Bill brownish black. Iris black. Feet brownish black, soles yellow. Bill 17-20, wing 92-103, tail 65-77, tarsus 36-42, mid toe 23-28 mm. (Fleming's mmts.) *Adult Female.* Smaller and more brown on upper surface, less yellow on underparts. *Immature* similar to adult female, light shaft lines more pronounced on crown and nape, lower breast and abdomen whitish and less in extent. *Colour Variety.* A partial albino described by Buller had the back and under surface white; white intermixed irregularly elsewhere but quills and tail normal; bill and feet yellow.

Eggs. Clutch two to four, elliptic, creamy white, with light brown blotches all over but mostly at the larger end, 24.5 x 19, 26 x 18 mm. South Island. Finely and closely spotted all over with brown markings concentrated at the larger end. 25.4 x 19, 26 x 18.8 mm. Chetwode Islands.

Status. The North and South Island Robins are very much alike in appearance, the southern one being larger, without white shafts showing on the upper surface except on the crown, without mottled throat and breast, and with the light colouring on the under surface more yellowish and with a sharp dividing line on the breast. The first year's plumage resembles somewhat the adult plumage of the North Island Robin, having white shaft lines above and a small white area on the under surface. This relation between closely allied forms is found in other species of birds. The Stewart Island Robin differs from the South Island Robin less than the North Island Robin differs from the South Island Robin.

Distribution. From D'Urville Island and the Chetwode Islands in the Marlborough Sounds districts southwards to Foveaux Strait. Irregularly distributed and altogether absent from most of Canterbury and Otago east of the forested mountain regions. It reaches near the east coast in the Seaward Kaikouras in Marlborough and Flagstaff Hill in Otago.

Ecology. The forest interior, especially near the ground, and the scrub along the forest edge are the ordinary stations of the South Island Robin. Here it finds its food which consists mainly of insects and earthworms collected among the leaves and sticks on the forest floor. The South Island Robin quickly retreated before the advance of civilization and it was feared that it might become extinct. The main cause of the decrease was doubtless the depredations of rats, cats and stoats to which the birds would fall an easy prey. Its strong attachment to its own territory resulting in its remaining too long in the presence of danger would help its destruction. However it is now perhaps becoming somewhat adapted to the changed conditions as it is fairly plentiful in some localities. Strangely enough it is not much perturbed by motor traffic for in the Eglinton Valley it is encountered in the forest a few yards from the road.

Voice. In the seventies of last century Potts wrote: "This bird as a songster is perhaps unequalled by any native warbler, and we think scarcely surpassed by any of the woodland melodists of the old country."

Nesting. The Robin's nest is usually placed not far above the ground and may be among the exposed roots of a large tree, in a cluster of vines, kiekie or other dense vegetation or in a hollow in the trunk of a tree left by a decayed branch. The nest is a cup-shaped structure in which the coarser materials such as grass, twigs and moss are woven into a firm foundation and the egg hollow is lined with fine grass, tree-fern scales and sometimes feathers.

The most complete account of the nesting habits of the South Island Robin is Richdale's description obtained by Mr. W. D. F. King and himself watching birds in an aviary. Nothing could better demonstrate the value of keeping birds in captivity than this achievement. Richdale's account is so replete with details of the behaviour of the birds that it cannot be condensed sufficiently to print here so a few facts taken from his brochure must suffice. The eggs were laid on September 19th and 20th and took twenty days to incubate. The female built the nest and did all the incubating. Her food was brought to her by the male. For the first ten days only the female fed the chicks, the male preparing the food by cutting it into small pieces. When about ten days old larger pieces of insects were fed to the chicks which were fully fledged when three weeks old. They then left the nest but stayed on the branch for nine days.

L. E. Richdale
SOUTH ISLAND ROBIN

Robins have a strong territorial instinct and other birds trespassing on the area which they claim and live in are fiercely attacked and driven away. The young are treated in the same fashion after they are able to look after themselves.

References.—Sparrman, Mus. Carls., 3, No. 79, 1788 (*Turdus australis,* Dusky Sound). Gray, Zool. Erebus and Terror, Birds, 7, col. pl. 1845. Buller, Birds N.Z., 122, 1872; 2nd ed., 1, 36, col. pl. 1888. Moncrieff, Emu, 32, 52, 1932. Richdale, Southern Robin [Dunedin], 1941. Fleming, N.Z. Bird Notes, 2, 125, 1946.

Stewart Island Robin

Miro australis rakiura

No doubt well known to the early sealers and settlers, the Stewart Island Robin first appeared in an ornithological paper in 1872 when J. G. Black published a list of "Birds shot between Port William and Port Adventure." Cockayne said that it was plentiful in 1908 in the virgin forest of Stewart Island but had altogether left the settlements.

Adult. Similar to *M. a. australis* but with the upper surface darker and the abdomen greyish white; size smaller and frontal spot smaller; more or less pronounced light shafts to the feathers of the crown and neck. Bill

16-18.2, wing 87-98, tail 64-75, tarsus 34-39, mid toe 23.5-27 mm. (Fleming.)

Eggs. Clutch two or three, ovoid, greyish cream with dark brown, pale brown and grey blotches at the larger end, elsewhere scattered. 24 x 18.4, 24.5 x 18.2 cm. Another clutch 25.5 x 19, 25.4 x 18.4 mm. Solomon Island. Guthrie-Smith records a nest with five eggs on Herekopere, and one with two eggs on Solomon Island.

Distribution. Stewart Island and adjacent islets on the south-west and east sides; Big South Cape, Jacky Lee, Green, Solomon and Pukeweka Islands. On the main island from lower Freshwater Creek southwards.

Ecology. The Stewart Island Robin occurs in forest from sea level to its upper limits. It is frequent along the forest margin. Guthrie-Smith observed a seasonal migration, the Robins occupying the valley bottoms during the breeding season and moving to the higher ground in the autumn. The Robin is still frequent south of Paterson Inlet but has altogether disappeared from the settled districts north of the inlet. This is unquestionably the result of the introduction of rats and cats, the latter probably being the greater menace. "Wherever a man builds," writes Guthrie-Smith, "even the smallest hut and wherever the weka is killed out rats follow, and the Robin is at once exterminated."

Nesting. The breeding habits of the Stewart Island Robin have been described by Guthrie-Smith from some of the outlying islets. On Herekopere a nest "was built about nine feet from the ground in an immense cluster of close packed dead bush vine logs, tendrils and curls." On Solomon the nests were built under the shelter of masses of fern leaves, or under projecting branches of trees, as Guthrie-Smith says, to "ensure the preservation of the race" because of the nightly shower of petrels arriving at their nesting sites. A nest from Solomon Island collected by E. F. Stead is composed of roots, leaves and moss lined with fine rootlets and grass.

References.—Guthrie-Smith, Mutton Birds, 50, 1914; Bird Life, 120, 1925. Fleming, Trans. Roy. Soc. N.Z., 78, 141, 1950 (*Petroica* (*Miro*) *australis rakiura*, Jacky Lee Island).

Black Robin

Miro traversi

This species was one of the discoveries made by H. H. Travers when he visited the Chatham Islands in 1871. The specimens were sent to Hutton and later to Buller. Each described it, using the specific name *traversi* after its discoverer. Travers found it on Mangere Island, but it exists now only on Little Mangere where it is not common.

Adult. Upper surface brownish black; quills brown; tail and under surface blackish brown. Bill black. Iris dark brown. Feet blackish brown, soles yellow. Bill 13.4-14, wing 81-86, tail 61-68, tarsus 30-33, mid toe 21-25 mm. *Immature.* Similar to the adult but contour feathers with light brown tips.

Status. The Black Robin is a species of equivalent status to the New Zealand Robins. It differs in its uniform dark coloration, smaller size and slightly longer first primary in comparison with the second. Formerly confused with or allied to the Black Tomtit of the Snares but it differs from that species in the characters which separate the two genera.

Distribution. Chatham Islands. Formerly on the main island and adjacent islets, now found only on Little Mangere Islet.

Ecology. The only members of this species now existing are between twenty and thirty-five pairs, according to Fleming's estimate, on the island of Little Mangere. Formerly on all the islands of the Chatham group it had disappeared from the main island, Wharekauri, by the time of Travers' visit in 1871, it being then found only on Mangere and Little Mangere. On Mangere rats and rabbits had been introduced, the former accidentally, and at the beginning of the present century cats were liberated to destroy these pests. They soon exterminated the Black Robin so that it now exists only on Little Mangere. The Robins now live in the scrub and coastal forest that covers the island.

Habits. Travers, who discovered this species, writes: "I only found this bird at Mangere, where it is not uncommon. It is very fearless, possessing in other respects the habits of [*Miro australis* and *M. longipes*]. Its ordinary note is also the same, but I did not hear it sing. It appears to be specially noxious to *Anthornis melanocephala,* which always attacks it most savagely when they meet."

Fleming writes regarding his visit to Little Mangere: "The Robins are territorial, and as we passed from one area to another the birds would come up to within a few feet of us, as do their mainland congeners, sometimes alone, sometimes both birds of a pair. Their song was somewhat similar to that of *Miro longipes,* but not nearly so full in tone, nor so varied in composition. An empty nest, which I believe was a Robin's, was situated low down at the base of a branch and almost sheltered above by a higher branch. It was fairly bulky with a small cup neatly lined with a few feathers."

References.—Buller, Birds N.Z., 123, 1872 (*Miro traversi,* Chatham Islands); 2nd ed., 1, 38, 1888; Suppl. 2, 125, col. pl. 1905. Rothschild, Extinct Birds, 15, col. pl. 1907. Fleming, Emu, 38, 507, 1939; Trans. Roy. Soc. N.Z., 78, 143, 1950 (*Petroica* (*Miro*) *traversi*).

FAMILY RHIPIDURIDAE

Bill wide at base, shorter than head. Fourth and fifth quills longest. Tail longer than wing, rounded. The essential character of this family lies in the maxillo-palatines which are flat and scimitar-shaped with L-shaped extensions in front of the vomer. The only other New Zealand family with flat maxillo-palatines is Acanthisittidae.

GENUS RHIPIDURA

Bill much shorter than head, broad at base. Mouth bristles longer than bill. Second primary equal to secondaries, fourth and fifth longest. Tail longer than wing, rounded. Tarsi scutellate.

Recognised by the long tail and scutellate tarsi. From India to Australia, Tasmania and Western Polynesia.

Key to New Zealand Species

Tail mostly white	*R. flabellifera*
Tail black	*R. fuliginosa*

References.—Vigors and Horsfield, Trans. Linn. Soc., 15, 246, 1827 (*Rhipidura,* type *Muscipapa Flabellifera* Gmel.). Oliver, Emu, 45, 143, 1945 (palate).

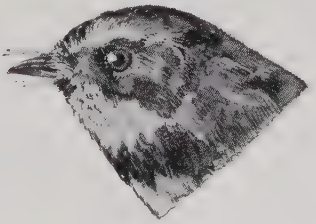
North Island Pied Fantail. Piwakawaka
Rhipidura flabellifera placabilis

The North Island Pied Fantail was discovered at the Bay of Islands by Lesson, naturalist on the *Coquille* which visited New Zealand in 1824. It was mentioned by Yate in 1835, and collected by the United States Exploring Expedition in 1840 and by the British Antarctic Expedition in 1841, all at the Bay of Islands.

Adult. Slightly paler than the South Island subspecies, *R. fl. flabellifera*; a restricted white tip to the central tail feathers; the outer web of the second to fifth tail feathers black from the edge almost or quite to the shaft, and the inner webs washed with dusky grey, making the under surface of the tail darker than in the other subspecies of Pied Fantails. Bill 8, wing 72-76, tail 92-100, tarsus 18-19, mid toe 13-15 mm. *Colour Varieties.* A specimen recorded by H. G. Bailey was creamy white, breast pale buff, tail white but appeared darker when closed.

Eggs. Clutch three. 16.5 x 14 mm. Kapiti Island. 16 x 12.5 mm. Wanganui.

Distribution. Three Kings Islands. North Island, Mokohinau, Hen and Chickens, Little Barrier, Great Barrier, Mayor Island, Kapiti. Common throughout.



E. H. Atkinson

NORTH ISLAND FANTAIL

Ecology. The North Island Pied Fantail, like its southern relative, has thoroughly adapted itself to the conditions of European settlement which has considerably widened the type of habitat, namely open forest and scrub, plantations and gardens, which it favours. It has invaded the exotic pine forests in the Whakarewarewa and Kaingaroa Plains districts. Probably its numbers have increased since the advent of Europeans. It is a particularly friendly bird and comes into gardens and even houses seeking flies and other insects. In the Wairarapa valley, a settled district, according to Stidolph it is more often seen in town gardens from January to July when it moves out to its breeding quarters in the more extensive gardens, especially those with a creek and where there is thick shrubbery, and also to remnants of native bush and to thickets on or near river beds, the fantail being much more circumscribed in its movements during the breeding season. Fantails flock together after the breeding season. In the Kaihu valley in March I have had twelve flitting round me and now and then settling on my shoulder or head.

Nesting. Fantails usually select small trees or tall shrubs for their nests near the forest edge, or in patches of bush or scrub, as well as in plantations and gardens, and place the nest at the fork of a slender branch. The nesting season lasts from August to January, during which time two or three broods may be raised. Mr. Wilkinson, when Caretaker of the Kapiti Island bird sanctuary, supplied me with the following notes: "Nest perched on a branch usually near a stream of water, often has a long tail but many without it. Both sexes build and both incubate. Young leave nest when fifteen days old." Observing a pair of Fantails at Palmerston North D. Park states that both birds help to make the nest, the male doing most of the work of carrying materials and the female doing most of the building. He says further that incubation is carried out by both birds. Recently the incubation period was determined by J. M. Cunningham as almost exactly fifteen days.

Kapiti Island *Amy Wilkinson*
NORTH ISLAND FANTAIL

References.—Gray, Zool. Erebus and Terror, 8, col. pl. 1845. Smith, Trans. N.Z. Inst., 41, 1, 1909. Guthrie-Smith, Birds, Water, Wood, Waste, 127, 1910. Bangs, Bull. Am. Mus. Nat. Hist., 44, 583, 1921 (*R. flabellifera placabilis,* North Id.). Mathews and Iredale, Ibis, 1913, p. 441 (*R. fl. kempi,* North Id.) Fleming, N.Z. Bird Notes, 3, 190, 1949. Wilkinson, Kapiti Bird Sanct., 63, 1952. Turbott and Buddle, Rec. Auck. Mus. 3, 330, 1948.

South Island Pied Fantail. Piwakawaka

Rhipidura flabellifera flabellifera
(semispecies)

The South Island Pied Fantail was taken by Forster during Cook's second voyage on the day after the expedition entered Dusky Sound. Its habit of executing various evolutions on the wing while catching insects, spreading its tail fanwise and all the time uttering its pleasant twitter were all noted by Forster. The name *flabellifera* is Gmelin's rendering of Latham's "Fantailed" flycatcher. After the visit of Cook the South Island Pied Fantail is not mentioned, so far as I am aware, for nearly a hundred years when Potts in 1870 published an excellent account of its nesting habits in Canterbury.

Adult. Forehead, lores and band through eye narrowing behind sooty black; a greyish white streak above each eye; crown, nape and sides of face blackish grey; back and wings dark olive brown; small wing coverts tipped and inner secondaries edged with fulvous white; two central tail feathers brownish black with white shafts and tips; second to fifth tail feathers greyish white with outer part of the outer webs brownish black; outer tail feathers greyish white. Chin and throat greyish white; a band of blackish grey across the upper chest; lower chest and abdomen yellowish rufous; under surface of tail almost clear white. Bill and iris black. Feet blackish brown. Bill 6-8, wing 72-75, tail 95-100, tarsus 16-18, mid toe 15 mm. *Immature.* Similar to adult but both upper and under surface more or less tinged with fulvous brown. *Colour Varieties.* Pure albinos have been recorded, also one instance of a partial albino. Handley described a specimen from Marlborough having a pure white wing but otherwise normal. *Hybrids.* The relationship of the South Island Pied Fantail to the Black Fantail is discussed under the latter species.

Eggs. Clutch three or four, broadly ovoid, white, with small light brown blotches all over but most numerous in a zone round the larger end, 16.5 x 12, 16 x 12.5 mm. Christchurch.

Status. According to the characters of the tail the New Zealand Pied Fantail may be divided into three subspecies: *R. fl. placabilis,* North Island, blackish brown on outer webs of second to fifth rectrices extends from shaft to edge, small white tip to central feathers; *R. fl. flabellifera,* South Island, a narrow white strip along shaft of second to fifth rectrices, remainder of outer webs blackish brown, larger patch of white at tips of central feathers; *R. fl. penitus,* Chatham Islands, a broad white strip along shafts of outer webs of second to fifth rectrices, margin brownish black, a broad white band at tips of central feathers. The central rectrices are counted as the first, the outermost ones as the sixth.

A number of forms found in Australia and the south-west Pacific Islands hitherto treated as species are now linked with the New Zealand Pied Fantail as subspecies.

Distribution. D'Urville Island. Chetwode Islands. South Island. Stewart Island. Codfish Island. Solanders. Throughout and always outnumbering the Black Fantail by four or more to one.

Ecology. The Pied Fantail is found almost everywhere, though perhaps its proper stations are the forest and scrub, especially the outskirts. It is common in all parts of the country and quickly makes its presence known, coming right up to the visitor. So fearless and friendly is it that it will remain in his vicinity and even settle upon him between its numerous short excursions into the air to catch insects. After the breeding season, small flocks are sometimes encountered and it is chiefly during the autumn and winter that it is found most plentifully in the settled districts. It is quite a welcome visitor to camps and country homesteads, especially in sandfly-infested districts, as it does not hesitate to enter tents and houses and soon clears them of all the insects in sight.

W. W. Smith says that the Fantails breeding in the hills of inland Canterbury move across the plains after the nesting season and visit gardens and plantations. Stead relates that during the severe winter of 1918 in Canterbury there were not in the cultivated parts any survivors while in the native bush they suffered little more than in a normal winter. Stead also states that large numbers of Fantails fall victims to stoats, black rats and cats.

Food. The food of the Fantail consists almost entirely of small insects which it takes on the wing. It hawks about near the tree tops and within the forest, and especially over streams where small flying insects usually abound. Its evolutions with outspread tail are a never failing source of interest, while the continual snapping of its beak tells of its success among its small-winged prey. The Fantail is thus a useful bird in clearing away small flies, including sandflies, from houses and tents and small insects from orchards.

Voice. A pleasant twittering note is constantly emitted by the Fantail, while on the wing and when settled for a moment on a branch. The bird seems always moving, for between its aerial excursions it moves its head and body from side to side to the accompaniment of its twitter. "The note," observes Andersen, "passes from a sustained tweeting, or chatting, through a double warble, to a cheery whistled song of fair compass and considerable variation."

Nesting. The site chosen by the Fantail for its nest is usually a small tree or tall shrub on the edge of the forest or not far within it and almost always not far from a stream, probably because there is generally a good supply of insects hovering over the water. The Fantail builds a very compact nest which is placed usually in the smaller branches of a shrub or tree. The nest is composed of grass, moss, rootlets, bark, lichens and cobwebs, closely woven together and to the support, and lined with fine grass culms, hair, moss-fruit stalks, bulrush flowers and other similar materials. Sometimes but not always there is a tail to the nest. Two or sometimes three broods are raised in a year, the parents generally beginning the second or third nest while feeding the young of the previous brood. Both birds share in nest building, also in incubating the eggs, changing at frequent intervals.

References.—Gmelin, Syst. Nat., 943, 1789 (*Muscicapa flabellifera,* Dusky Sound). Potts, Trans. N.Z. Inst., 3, 77, 1871. Buller, Birds N.Z., 143, 1872; 2nd ed., 1, 69, col. pl. 1888. Philpott, Trans. N.Z. Inst., 51, 218, 1919. Andersen, Bird Song, 18, 1926. Moncrieff, Emu, 31, 111, 1931. Stead, Life Hist. N.Z. Birds, 130, 1932. Fleming, N.Z. Bird Notes, 3, 190, 1949.

Chatham Island Pied Fantail

Rhipidura flabellifera penitus

The first record of the Pied Fantail in the Chatham Islands was that of H. H. Travers who lists it as being seen during his second visit to the group in 1868. He also met with it during his third visit in 1871. In describing Travers' specimens Hutton noticed that the white on the tail feathers is purer than it is in New Zealand specimens.

Adult. Similar to *R. fl. flabellifera* but the black margin on the outer web of the second to fifth tail feathers narrower so that a broad strip of white lies along the shaft; a broad white tip to the central tail feathers; under surface of the tail almost pure white except for an outer grey line.

Status. The Chatham Island Fantail is exceedingly close to the South Island subspecies but the characters such as they are appear to be constant.

Distribution. Chatham Islands. Wharekauri, most frequent in the north of the island. South East Island. Pitt Island.

Habits. Nothing has been published concerning the habits of the Chatham Island Fantail other than Archey and Lindsay's record of finding a nest with four fledglings on December 16th.

References.—Bangs Proc. Biol. Soc. Wash., 24, 41, 1911 (*R. flabellifera penitus,* Chatham Island). Fleming, Emu, 38, 506, 1939; N.Z. Bird Notes, 3, 190, 1949.

Black Fantail. Piwakawaka

Rhipidura fuliginosa (semispecies)

The Black Fantail was discovered during Cook's second voyage and was described by Sparrman who joined the expedition at the Cape of Good Hope. It was, indeed, named before the Pied Fantail, so that if the two forms were united as one species the rules of zoological nomenclature would require it to be called *Rhipidura fuliginosa,* a name that aptly applies only to the Black Fantail. The next specimens of the Black Fantail to be collected appear to be those obtained by Dieffenbach in 1840 and by the French expedition under d'Urville about the same time, the latter specimen being from Otago. It was first seen in the North Island in 1861 and a specimen was obtained in the Manawatu district in 1864.

Adult. Head and neck greyish black; back and wing coverts black, tinged with rusty brown; quills dark brown; tail black. Under surface from lower breast to tail chocolate-

E. F. Stead

BLACK FANTAIL

brown. Bill black, the base of the lower mandible white. Iris black. Feet black. Bill 6-7, wing 72-77, tail 94-103, tarsus 18-20, mid toe 13-15 mm. The female has a white spot over each ear covert. *Colour variety.* There is in the Wanganui Museum a white specimen with brown on both inner and outer webs of the tail feathers.

Eggs. Pied male and black female, 16.6 x 12.6, 16.4 x 12.4 mm.

Status. The Black Fantail is intimately related to its pied relative. However it breeds together producing its kind and its area of distribution is different from that of the pied species in that it extends over only part of the range of the pied bird, namely, South Island, North Island, where it is rare and probably a late immigrant from the South Island, and not at all in the Chatham Islands. The Black Fantail is a twin species or semispecies with the Pied Fantail. Accordingly the two forms should be considered as of equal rank taxonomically and nomenclaturally and neither should be submerged in the other. The Black Fantail is a very distinct entity with all the characteristics of a species except that it is not yet sufficiently distinct physiologically from the Pied Fantail to act as a barrier to cross fertilization.

The Black Fantail has been called a mutant of the pied form. But there are reasons for considering black to be the basic colour and piedness to be due to a factor, now dominant, added in the course of evolution. Where Black Fantails are most dense, in Otago, the proportion of black to pied forms is about one to four. These figures are derived from several counts made by Mrs. I. Tily in Dunedin.

The interbreeding of Black and Pied Fantails was first noticed by Potts before 1870. He said that the two forms breed together frequently. The progeny of seventeen union pairs of which I have records, including four hitherto unpublished, totalled 31 black and 30 pied young, that is to say, the colours come out in approximately equal proportions. There were both black and pied chicks in all the broods except one in Canterbury consisting of four pied (information from L. A. Shand), and one in D'Urville Island consisting of three black chicks (own observation). No birds of intermediate colours have been recorded among black and pied fantails. The proportion given above could be produced if there was only a single factor for piedness. Assuming piedness to be dominant to blackness then the progeny of a heterozygous pied bird and a black one would on an average be half pied and half black. The case of two pied birds producing a black and two pied chicks (information supplied by E. F. Stead) could be explained on the assumption that both parents were heterozygous. This theory, however, would not explain six reported cases of two black parents producing both black and pied chicks.

There is no need to suppose that the Black Fantail in the North Island is a phase of the North Island Pied Fantail. It is much more probable that the Black Fantail has invaded the North Island from the South Island, indeed its known history in the North Island points this way. Only one place of origin is thus required for the Black Fantail.

Distribution. North Island and Kapiti Island, scarce. The Black Fantail was first noticed in the North Island in 1861. In 1865 Buller shot a specimen in the Manawatu district after a storm which he supposed brought it from the South Island. Since that time it has been seen in the following localities: Hokianga, Leigh, Auckland, Clevedon, Papatoetoe, Pirongia Range, East Cape, Napier, Ohakune, Rangitikei, Wairarapa Plains, Levin, Wellington. D'Urville Island. South Island, fairly common throughout, in the south forming about twenty-five per cent. of the numbers of the pied form. Stewart Island. Snares, Buller records having received a specimen.

References.—Sparrman, Mus. Carls. 2, 47, 1787 (*Muscicapa fuliginosa*, South Island). Jacquinot and Pucheran, Voy. Pole. Sud., 3, 76, col. pl. 1853 (*Rhipidura tristis*, Otago). Buller, Birds N.Z., 146, 1872; 2nd ed., 1, 72, col. pl. 1888. Fleming, N.Z. Bird Notes, 3, 190, 1949. Oliver, N.Z. Jour. Sci. Tech., 8, 334, 1926.

FAMILY ZOSTEROPIDAE
SILVEREYES

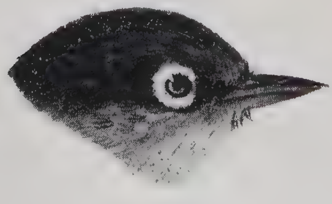
Bill equal to head or shorter. First primary nearly as long as the second. A ring of short white feathers surrounds the eye.

A large number of species all referred to one genus, ranging throughout Africa, South and East Asia, Malaya, Australia, Tasmania, New Zealand and the Pacific Islands.

Genus Zosterops

The Silvereyes are small birds, easily recognised by the silvery white ring round the eye. In the New Zealand species the true first primary is absent so that the "first" primary mentioned in the key to the families of Passeriformes and in the diagnosis of the Family Zosteropidae is really the second primary.

Reference.—Vigors and Horsfield, Trans. Linn. Soc., 15, 234, 1827 (*Zosterops*, type *Sylvia lateralis* Latham).



Margaret A. Morison

SILVEREYE

Silvereye. Tauhou
Zosterops lateralis

The Silvereye was observed at Waikanae in June, 1856, large flocks appearing in the scrub along the coast. The announcement of this jogged the memories of several people living in Otago who said they remembered the Silvereye in the Southland district before 1856, the earliest appearance being given as 1832 at Milford Sound. Being a restless species it is unlikely that the Silvereye would remain in any locality for any length of time, and so the Otago records were perhaps based on a small invasion that failed to establish itself. Shortly after its appearance at Waikanae the Silvereye was seen in Wellington and did good service by clearing gardens of woolly aphis. After three months it disappeared and was not again seen until the winter of 1858, and the four succeeding winters. Apparently, therefore, it regularly migrated between the North and South Islands for a few years after arriving in New Zealand. In 1862 it commenced to breed in the North Island, a nest having been found in that year at Te Wairoa, Hawke's Bay. It reached Wanganui in 1863, Auckland in 1865 and the Bay of Islands in 1867. The history of the Silvereye in the South Island is somewhat similar to that in the North Island. Potts first observed it in Canterbury after some rough weather in July, 1856. It was a yearly winter visitor to Nelson from 1856 to 1861 and was observed in Otago in the summer of 1860 and in the north of Canterbury in the following summer. Thus all the reliable evidence available indicates that the Silvereye arrived in New Zealand in large numbers in the winter of 1856, and migrated between northern and southern districts for a few years before becoming permanently established in both islands. It was reported in the Chatham Islands after a storm in 1861 and found its way to the Kermadecs, Snares, Auckland, Campbell and Macquarie Islands, though not always to become established.

Adult. Top and sides of head, and hind neck yellowish olive; back, scapulars and wing coverts cinereous, tinged with green; rump and upper tail coverts yellowish olive; quills brown margined outside with yellowish olive and, except the first primary, inside with white; tail feathers brown with outer edges, except on the outer feathers, yellowish olive and the inner edges white. A silvery white ring round the eye with a black line below extending to the lores. Throat greyish white, washed with yellowish olive; breast and centre of abdomen greyish white; sides pale chestnut; under tail coverts greyish white, tinged with yellow. Bill brown, darker on the culmen. Iris reddish brown. Feet light brown. Bill 10-12.5, wing 57-68, tail 42-50.5, tarsus 15.5-19, mid toe 12.5-16 mm. (Marples' mmts.). *Immature.* Paler than the adult but throat and breast pale ashy grey and sides of body fulvous brown; white eye ring absent. *Colour Varieties.* In the Otago Museum is a specimen from Otago Peninsula which is white with the back and wing coverts lemon-yellow; there are some normal feathers on the wings and back. A specimen in the Auckland Museum has the head, wings, rump and tail canary-yellow; back and under surface white; sides of abdomen stained with brown. In this specimen the green of the normal plumage is replaced by yellow and the remainder, except the brown sides, is white.

Eggs. Clutch three or four, ovoid, pale greenish blue, 18 x 13, 17.5 x 13.5 mm. Banks Peninsula. 17.8 x 13.4, 16.8 x 13.2 mm. Chatham Islands.

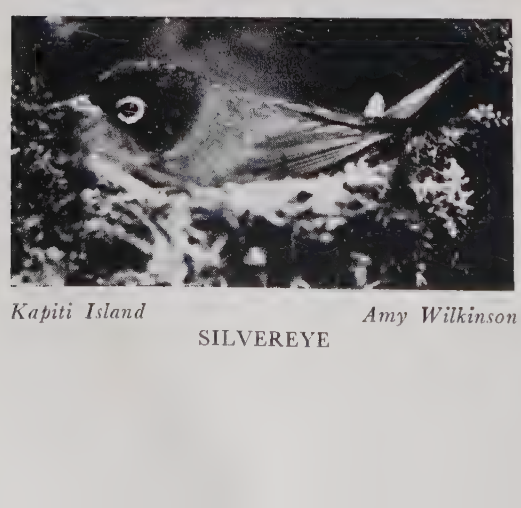
Status. The New Zealand Silvereye is identical with the species *lateralis* of south-eastern Australia and Tasmania. *Z lateralis* is nearest to *Z. tephropleura* of Queensland, which, according to Mack, differs in the grey mantle and breast, the lemon yellow under tail coverts, and the lack of tawny on the flanks. The species are closely allied, and Marples has recorded twenty per cent. of New Zealand birds having "yellow" under tail coverts.

Distribution. Kermadec Islands, Three Kings, North Island, Mokohinau, Hen and Chickens, Little and Great Barrier Islands, Karewa, Mayor Island, Kapiti, South Island, D'Urville, Chetwode, Stewart, Solander, Chatham, Snares, Auckland, Campbell and Macquarie Islands. Abundant throughout except at the Kermadecs where it was seen by Cheeseman in 1887, but was not present in 1908, when I stayed at the group.

South Australia, Kangaroo Island, Victoria, New South Wales, Tasmania, Queensland. Norfolk Island. Lord Howe Island, introduced from Norfolk Island and New South Wales. Transferred from New Zealand to Cook Islands, 1926.

Ecology. Almost everywhere may the flocks of this energetic and restless little bird be encountered, along the sea coast, including nearly all the outlying islands, in the manuka scrub and fern country of the lowlands, in the tussock land and scrub of the mountains and in the forest, though it prefers the outskirts to the interior. It has been recorded from an altitude of 4,000 feet on Mount Egmont. After the breeding season it gathers in flocks and invades the settled districts, coming into gardens and yards, even in the larger cities. It is generally hard pressed in winter from lack of food and from cold, and sometimes succumbs to the severity of our climate. Numbers have been found killed after storms in Canterbury, and Travers records that in the Chatham Islands many are killed by cold and hunger during severe winters. The flocking of Silvereyes in winter is part of a seasonal movement. In summer the birds scatter, often going to higher levels, to breed. In winter they descend and spread in flocks over the lowlands. There is hardly sufficient evidence to show migratory movements in a north and south direction, though Stead says: "There is a very considerable seasonal migration, birds from Otago and South Canterbury going north in the winter. In Christchurch this migration begins about the middle of April, and for a month, flocks of Blight-birds may be heard flying overhead at almost any hour of the night." On Campbell Island the Silvereyes are seldom seen in the breeding season but afterwards they are encountered in flocks.

The history of the Silvereye since 1856 when it was first observed in numbers in New Zealand was one of rather rapid expansion until it occupied the whole country. Since then the species has had its ups and downs. Cold and wet and shortage of food take their toll in winter. Cats easily catch the birds when they come down to feed on the ground. Noticeable reductions in numbers, probably temporary ones, have been reported in Hawke's Bay and Nelson. In the process of feeding the Silvereye acts as an agent in cross pollinating flowers and in distributing seeds, two essential conditions for a healthy forest. The distribution of seeds of native trees by the Silvereye was neatly demonstrated by L. W. McCaskill who prepared as a seedbed a strip of ground beneath a food receptacle. The Silvereyes were supplied with food from May to October. The following April McCaskill removed from the seed bed 144 seedlings belonging to at least eight species, namely, *Pittosporum tenuifolium, P. eugenioides, Coprosma lucida* and another, *Carpodetus serratus, Nothopanax colensoi, Pseudopanax crassifolium, Melicytus ramiflorus.*



Kapiti Island *Amy Wilkinson*

SILVEREYE

What concerns man most is the effect on his cultivated plants of this busy little bird which has alternately been praised and reviled by the orchardist. When it first appeared in New Zealand, which happened to be in winter time, it was welcomed because it soon set to work in gardens and orchards and cleared out the aphides and scale insects including the very obnoxious woolly aphis. When the fruit season came round, however, the Silvereye continued its investigations in the orchard, and freely helped itself to what fruit happened to be there. Spreading quickly throughout the country, it varied its fruit diet accordingly, and peaches, figs, cherries, plums and others were attacked. Perhaps a fair estimate of the economic importance of the Silvereye is that it performs a valuable service for many months of the year in clearing gardens and orchards of small insect pests, including the destructive diamond back moth, but in the fruit season it destroys a quantity of soft fruits. Probably its useful service well overbalances the harm it does. But incidental to the process of eating fruit the Silvereyes spread seeds of weeds and, it is reported, diseases of fruit such as brown rot. Lastly they flock to camps and feed on what fat, suet, butter and other food they find uncovered.

Food. The natural food of the Silvereye consists of insects, nectar and soft fruits. The numerous species of nectar bearing trees in New Zealand, such as the rata, fuchsia, rewarewa, puriri, flax and kowhai provide an abundance of sweet food during the spring and summer, while later in the season fruit is obtained from the coprosmas, makomako, mingimingi and other plants. For the rest of the year, insects are diligently sought for in forest, scrub and plantation. Not infrequently the Silvereye obtains sandhoppers from the sea shore. When feeding it seems continually to be changing its food, first perhaps feeding on fruit, then searching for insects and eventually coming back to the fruit.

Voice. A constant twittering of rather plaintive notes proceeds from a flock of Silvereyes when feeding or migrating. When alone, however, the Silvereye sometimes sings a pleasant, low, almost whispering song, which, according to Andersen, is composed of a few phrases combined in various ways as in the song of the lark.

Nesting. The breeding season of the Silvereye extends from September to January or, occasionally, February. Two or three broods are raised in a season. The Silvereye's nest is generally placed in a shrub or small tree or even in bracken fern and not far from the ground. Manuka scrub is quite a favourite nesting site. The nest is a cup-shaped structure of even thickness throughout and suspended by the rim to the slender branches of the tree in which it is placed. It is composed of fine roots, grass, lichens, moss and spider webs firmly bound together. Hair or wool is used whenever it can be obtained. Both birds share the work of nest-building and incubation. The period of incubation is eleven days, occasionally twelve days, and the young leave the nest when about ten days old. While in the nest, they are fed by the parents on crushed insects and spiders. After the breeding season Silvereyes flock together but apparently remain paired as they roost at night in trees in pairs which sit close together like lovebirds.

Maori. The Maori passed over no bird on account of its small size, so the little Silvereye, which soon appeared in immense numbers, was collected and potted. "They are not carefully plucked," writes Elsdon Best, "many feathers are left on and they are not cleaned. But that matters not. The hardy Tuhoean bush-folk crunch up the birds—head, bones, inside, remaining feathers and all—with great zest." The method of catching the Silvereye as practised by the Maoris of Tuhoeland was as follows, quoting again from Elsdon Best. "Two upright poles about five feet high are stuck in the ground, generally in a clearing near the edge of a forest. Across the top from pole to pole, is fastened a stick called the 'rongohua' and underneath that a cord or piece of flax is tied across from pole to pole. This string is the 'tau maimoa,' and to it are tied the first few birds caught, generally by the beak. These birds being alive make great efforts to escape, and thus, in their fluttering, attract other birds. The fowler, rod in hand, is seated beneath a light shelter of boughs or fern-fronds, and strikes down the birds as they flutter about the 'tau maimoa.' "

References.—Latham, Ind. Orn. Supp., lv, 1801 (*Sylvia lateralis,* New South Wales). Buller, Birds N.Z., 80, 1872; 2nd ed., 1, 77, col. pl. 1888; Suppl. 2, 149, 1905. Potts, Trans. N.Z. Inst., 2, 61, 1870. M'Lean, Emu, 11, 223, 1912. Guthrie-Smith, Birds, Water, Wood, Waste, 135, 1910. Andersen, Bird Song, 106, 1926. Wilkinson, Amy, Emu, 31, 157, 1931. Stead, Life Hist. N.Z. Birds, 139, 1932. Fleming Emu, 42, 193, 1943. Marples, Emu, 44, 227, 1945. Wilkinson, Kapiti Bird Sanct., 70, 1952.

FAMILY MELIPHAGIDAE
HONEYEATERS

Bill with prominent culmen; nostrils in large depressions, with a coriaceous operculum. First primary about half length of second. Tongue protractile, bifid, each half broken up into stiff fibres, forming a brush.

This family includes a large number of species with its headquarters in Australia but extending to the Malay Archipelago, Polynesia and New Zealand.

Key to New Zealand Genera

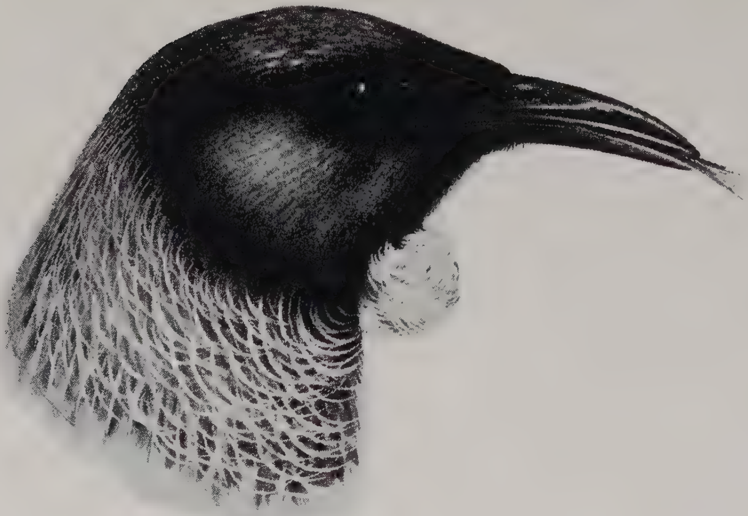
Tail rounded. A tuft of white feathers on the throat	*Prosthemadera*
Tail emarginate Second primary abruptly narrowed at tip	*Anthornis*
Tail rounded the feathers pointed	*Notiomystis*
Tail graduated. Wattles on sides of gape	*Anthochaera*

Genus Prosthemadera

Bill strong, arched. Fourth to sixth primaries longest. Tail slightly rounded. A tuft of curled white feathers on the foreneck.

A single species confined to the New Zealand region.

Reference.—Gray, List Gen. Birds, 15, 1840 (*Prosthemadera,* type *Merops novaeseelandiae* Gmel.).



R. J. Jacobs

TUI

Tui

Prosthemadera novaeseelandiae novaeseelandiae

Captain Cook while at Dusky Sound, in 1773, on his second voyage, wrote thus of the Tui. "Under its throat hang two little tufts of snow-white feathers, called its poies, which being the Otaheitean word for ear-rings, occasioned our giving that name to the bird; which is not more remarkable for the beauty of its plumage than the sweetness of its note. The flesh is also most delicious, and was the greatest luxury the wood afforded us."

During the same voyage, specimens of the Tui were obtained at Queen Charlotte Sound. They formed the subject of one of Forster's drawings and were described by Brown in 1776 as the New Zealand Creeper. Latham called this species the Poe Bee-eater and Gmelin's scientific name, *Merops novaeseelandiae,* is equivalent to New Zealand Bee Eater. Forster's specimens were reported as being in the Vienna Museum a hundred years after he collected them.

Other early references to the Tui include Crozet at the Bay of Islands in 1772, Anderson at Queen Charlotte Sound during Cook's third voyage in 1777, Bellinghausen at Queen Charlotte Sound in 1820, Lesson in the *Coquille* at the Bay of Islands in 1824, and Yate at the Bay of Islands in 1835. The British expedition in the *Erebus* and *Terror* under Sir James Ross brought to England several specimens collected in New Zealand and at the Auckland Islands. The Tui was seen on Raoul Island by T. F. Cheeseman in 1887 and he noted that its song differed slightly from that of its New Zealand relatives. Specimens were later obtained by T. Bell, and by the Kermadec Islands expedition in 1908.

Adult. General colour shining metallic green with bluish purple reflections on the shoulders, upper tail coverts and lower breast. The hind neck ornamented with filamentous plumes curving outwards and with a white line down the centre; back and scapulars bronzy brown; marginal coverts blackish purple, central coverts with outer portion white, forming a conspicuous alar bar; quills and tail feathers black on their inner webs. Two tufts of white filamentous curled feathers on the throat. Abdomen and sides reddish brown. Bill and feet brownish black. Iris dark brown. Bill 24-32, wing 135-158, tail 110-126, tarsus 33-40, mid toe 25-35 mm. *Immature.* Slaty black; a broad greyish white patch of varying size, more conspicuous in the female, on the throat; median wing coverts white; quills and tail feathers metallic green. *Colour Varieties.* Two types of colour varieties have been observed in the Tui. In the first group white feathers wholly or in part displace the normal plumage. Entirely white or almost entirely white birds have been obtained from Stewart Island, Westport and elsewhere. Partial albinos have been described from various localities. In these the white appears irregularly among the normal plumage and there may be smoky brown, cream or other colours as well. The second group includes those birds in which the general coloration is umber brown or cream colour, representing, apparently a stage between the normal colour and white. Cream, fawn, umber brown and smoky brown have been used to describe the predominant colours of birds belonging to this group; none is uniformly coloured. Buller describes a specimen with the fore part of the body smoky brown and the remainder pale creamy brown, while a specimen from Lake Waikaremoana which I saw in London in the possession of Mr. T. E. Donne, was greyish brown with the head, shoulders and breast dark brown with a greenish metallic lustre. Two similar specimens have been obtained at Raoul Island.

Eggs. Clutch three or four, rarely five, ovoid to long ovoid, pinkish or, less often, white, with pale red spots and blotches chiefly at the larger end, the smaller end sometimes quite clear of spots. 24 x 19.5, 27.5 x 19, 28.5 x 21, 30 x 21.5 mm. Raoul Island. 30.5 x 22, 30.6 x 22 mm. Banks Peninsula. 29 x 21.4 mm. Hawke's Bay. 32 x 23 mm. Adams Island.

Status. Two subspecies of Tui can easily be defined, one found from the Kermadecs to the Auckland Islands, the other confined to the Chatham Islands. The Chatham Island Tui is a larger bird with large throat plumes and there is a conspicuous amount of purple in the plumage.

Distribution. Raoul Island, Kermadec Group. Three Kings Islands. Last seen 1887. North and South Islands, Hen and Chickens, Mokohinau, Little Barrier, Great Barrier, Mayor Island, Kapiti, Chetwode Islands, Stewart Island and offlying islands. Auckland Islands. The Tui is at present not known north of Whangarei. It is more or less common elsewhere in the forest and in many places in the settled districts.

Ecology. The Tui is one of the most characteristic birds of the New Zealand forest, not so much of the gloomy interior as the upper lighted portion and the outskirts. Its station is among the tree tops, where the flowers and fruit are borne. When journeying from place to place it usually flies at a considerable height and descends suddenly to its destination. Its flight is particularly noisy and when darting through the forest or pursuing one another Tuis pass like a flash and disappear among the trees with a sound that earned for them among sealers the name Breaksea Devils, Breaksea being one of the sounds resorted to by sealing gangs.

The Tui has quite adapted itself to the changed conditions of European settlement, which frequently provides nectar bearing trees such as eucalyptus and acacia. It has also occupied the forests of exotic pines for the insects and flowers provided by the surroundings. There is no doubt, however, that the Tui population is considerably less than it was a century ago, and several districts remain depleted, but it is reported to be increasing in some localities. Buller maintained that the Tuis reached their lowest ebb about 1880 and after a law protecting them was passed began to increase. If this is correct it demonstrates the harm that is done by shooting.

The Kermadec Tui has undoubtedly decreased in numbers since Europeans established themselves on Raoul Island. When our expedition was there in 1908 there were a good many cats on the island and there were multitudes of Polynesian rats, *Rattus exulans.* Several Tuis' nests were found with the eggs destroyed by rats. In later years brown rats escaped from a wrecked ship. They attacked the Polynesian rat and no doubt would be a worse enemy of the Tui.

In the winter and early spring Tuis often leave the forest and travel far out into the settled districts where they may be seen feeding on the flowers of introduced trees such as the blue gum and fuchsia. Local migratory movements have been noted by Guthrie-Smith in Stewart Island, the Tuis moving towards the coast to breed in the spring.

The economic value of the Tui lies in its carrying pollen from plant to plant and in its destroying insects, particularly scale. Cheeseman long ago described the structure of the flowers of the rewarewa which, like several kinds of New Zealand trees, are adapted for bird pollination. More recently the relation of the Tui to the flowers it visits has been worked out by McCann who shows by drawings how the pollen becomes deposited on the bird's head when the beak is thrust into the flower. McCann formed the opinion that it is the irregular flowers like kowhai, puriri, phormium and clianthus that benefit most by the Tui's visits, while rata flowers are only accidentally cross pollinated. Tuis are bold and courageous, and rather pugnacious. Perhaps this character has been the cause of their being attacked and sometimes killed by companies of blackbirds and starlings. But there are casualties on both sides, for the Tui sometimes kills birds in the process of chasing them away from its self-defined territory.

Food. Insects, nectar and berries are the principal kinds of food for the Tui. Insects form the mainstay in winter after the berries are over. They are usually sought out on trees but are also taken on the wing. The method of eating large insects caught on the branches of trees has been observed by E. W. Hursthouse who stated that each mantis was grabbed about the middle of the body and then passed through the beak quite quickly from end to end and then swallowed whole, head first. All kinds of ripe berries are eaten and of these the New Zealand forest provides an ample supply

Kapiti Island *Amy Wilkinson*

TUI

during several months—mahoe, coprosma, supplejack, maire, mako, karaka and many others. The forest also provides a plentiful supply of flowers producing nectar. Most conspicuous are rata, kowhai, rewarewa and fuchsia, while scrub and swamp provide enormous quantities of flax (*Phormium*) flowers. The soft spadices of the kiekie are also, according to Buller, eaten by the Tui.

A most interesting scene is presented by the Tuis and Bellbirds feeding in the rata trees when in full bloom. The gorgeous crimson blooms of the rata are then infused with a new life by these two beautiful songsters clinging and swinging in all kinds of postures, sipping nectar and uttering their rich musical notes. Such is the scene that now gives pleasure to hundreds of holiday-makers who annually visit Ulva Island in Paterson Inlet, Stewart Island.

Voice. The Tui is undoubtedly one of the finest songsters in the New Zealand forest. Its song consists of a great variety of musical notes and is heard mostly in the breeding season. The song differs in different districts and from season to season. Andersen in his book on bird song gives seventy variations. The Tui is a competent mimic, imitating every kind of noise it hears including such things as a pig squealing, the whistle of a shepherd for his dogs, and the calls of other birds. It introduces such notes and various other sounds like sneezes, coughs and gurglings into its otherwise musical song. When singing, the Tui puffs out its plumage, and with the throat and beak open and tongue slightly protruded and with much gesticulation pours out its wonderful song. Of all the bush birds it sings earliest in the morning and latest at night. Part of its song is too high for human ears and then it may be seen but not heard singing.

It was noticed by Cheeseman and his companion Percy Smith in 1887, and by members of the 1908 party that the song of the Tui on Raoul Island differed from that of the New Zealand Tui. The characteristic bell note was seldom heard. In ten months Iredale recorded it only twice. The Tui on Raoul Island is not by any means silent but its notes consist mainly of those short gurgles, coughs and sneezes so often heard in New Zealand, while in the breeding season it emits a low trill. Like its New Zealand congener it is heard at night. It is mostly silent during rain. The Chatham Island Tui also is said seldom to utter its bell notes.

Nesting. The usual nesting site of the Tui is in a shrub or tree and from ten to thirty feet above the ground. In Canterbury Potts records nests under the shelter of rubus vines, beneath the heads of tree ferns and in the forks of manuka, matipo and other trees. Referring to the nightly landing of petrels on Solomon off Stewart Island Guthrie-Smith says: "On Kotiwhenu [Solomon Island] the Tui's nest is placed where protection is afforded by stout, small, covering boughs, branched clusters of twigs sufficiently stiff to fend off a falling bird." The nest is rather a large structure built of sticks, rootlets, leaves and a little moss and lichen and lined with grass and tree-fern scales and, occasionally, a few feathers. Nest building may begin in September, but the usual months for laying are October to December, occasionally in early January. Two broods are raised in a year. A nest at Clevedon, described by F. Murray, indicates that the period of incubation is about fourteen days, and the young leave when about fourteen days old. On Kapiti Island I am informed by Mr. Wilkinson that the young leave the nest when a fortnight old. According to the same observer they are fed during the first week entirely on insects and afterwards on berries. When rearing the young, Tuis tolerate no other birds in the immediate vicinity. While the female is sitting the male sings lustily from a neighbouring tree, and it is said that the female sometimes sings while sitting.

The site chosen for the Kermadec Tui's rather bulky nest is a fork in a pohutukawa (*Metrosideros kermadecensis*) tree twenty to thirty feet above the ground. In a sapling the nest is placed against the main stem, but in a larger tree it is built out in the branches where it is not easy to investigate. The foundation of the nest consists of sticks knit together with twigs of smaller calibre. Iredale mentions a nest built up almost a foot with stout twigs. The cup is lined with fine grass and a few feathers. Nest building commences in September and eggs are laid during the last week of the month. October is, however, the month when most eggs are laid. A few nests with eggs have been found as late as January. In a nest with three eggs investigated by R. S. Bell, the eggs were laid on September 29, 30 and October 1. All hatched on October 15 before midday. On October 29 the young were practically full feathered and on November 5 they left the nest. The incubation period is therefore fourteen days and the young leave the nest when about three weeks old.

References.—Gmelin, Syst. Nat., 464, 1788 (*Merops novaeseelandiae,* Queen Charlotte Sound). Buller, Birds N.Z., 87, col. pl. 1872; 2nd ed., 1, 94, col. pl. 1888; Suppl., 2, 144, 1905. M'Lean, Emu, 11, 182, 1912. Guthrie-Smith, Birds, Water, Wood, Waste, 152, 1910. Andersen, Bird Song, 112, 1926. Buddle, Bird Secrets, 22, 1951. McCann, Notornis, 5, 6, 1952. Wilkinson, Kapiti Bird Sanct., 72, 1952. Kemp, Austr. Av. Rec., 1, 124, 1912 (*P. n. kwini,* Auckland Is.) Mathews and Iredale, Austr. Av. Rec., 2, 113, 1914 (*P. n. kermadecensis,* Sunday Island). Iredale, Emu, 10, 4, 1910.

Chatham Island Tui

Prosthemadera novaeseelandiae chathamensis

The Chatham Island Tui was first collected by H. H. Travers in 1868, Travers noting that it was not uncommon on the main island and on Pitt Island, but he did not see it on Mangere. The next collection made was apparently by Forbes about 1882.

Adult. Stout bill and large throat plumes. The metallic green of the plumage is bluish and the purplish blue of the shoulders, wings, upper tail coverts, tail and lower breast is deeper in colour and more extensive than in the other subspecies. Bill black. Iris dark hazel. Feet blackish, yellowish on the soles. The male is considerably larger than the female as the following figures from Fleming show. Male: Bill 30-33, wing 160-170, tail 132-137, tarsus 40-47, mid toe 35-38, throat plumes 43-46 mm. Female: Bill 24-28, wing 143-148, tail 115-123, tarsus 37-40, mid toe 30-33, throat plumes 34-39 mm.

Status. The characters given above readily distinguish this subspecies. The female Chatham Island Tui is about the same size as the male of the New Zealand subspecies. The purplish blue of the Chatham Island subspecies is not so pronounced as in birds from the Kermadec Islands.

Distribution. Chatham Islands. Wharekauri, less common in the north than in the southern block where it was plentiful both in the Owenga and Tuku districts. (Fleming, 1937.) Pitt, Mangere and South East Islands.

Habits. In their report on the birds of the Chatham Islands Archey and Lindsay, in 1923, state that the Tui has always held its own and is common in all parts of the islands, particularly, in the season, among the flax bushes which have been planted around most of the houses. Broods of young birds just flying were seen by Fleming and Turbott on South East Island in late December. Concerning the song of the Tui on the Chatham Islands Mrs. Richards says: "It can sing but seldom does: it is too busy mocking others." This is an interesting statement as on the Kermadecs the Tui has practically lost its song though it has various other notes.

References.—Hartert, Nov. Zool., 34, 204, 1928 (*P. n. chathamensis,* Chatham Is.). Oliver, N.Z. Birds, 484, 1930 (*P. n. chathamensis,* Chatham Islands). Fleming, Emu, 38, 508, 1939.

GENUS ANTHORNIS

Bill slender, curved. Nostrils operculated. Third to sixth primaries longest; second primary abruptly narrowed towards tip. Tail emarginate.

A single species of three subspecies confined to the New Zealand region.

Key to Subspecies

Top of head olive green glossed with violet. Wing under 95 mm.
  Dull olive green. Bill up to 17.5 mm. .... *A. m. obscura*
  Olive green yellowish on under surface. Bill to 15.5 mm. .... *A. m. melanura*
Top of head deep purple. Wing 97-110 mm. .... *A. m melanocephala*

Reference.—Gray, List Gen. Birds, 15, 1840 (*Anthornis,* type *Certhia melanura,* Sparrm.).

Three Kings Bellbird

Anthornis melanura obscura

When Cheeseman visited the Three Kings in 1887 he saw a bird which he described as common, about the size of a Bellbird but the underparts were greyish white. Actually he was looking at a subspecies of Bellbird unfamiliar to him and not yet named. On his next visit two years later Cheeseman found Bellbirds "in great numbers" on Great King and South West King. In 1928 W. M. Fraser said that Bellbirds were met with everywhere. Specimens were collected by the *Will Watch* expedition in 1934 and on these Falla defined and named the subspecies.

Adult Male. Slightly larger than *A. m. melanura,* the bill averaging 3 mm. longer. General colour dull olive green, the under surface without the yellowish olive found in *A. m. melanura*; forehead, crown, sides of head, and throat glossed with dull violet; quills black, the secondaries edged with olive; tail black. Feathers on sides of breast and under tail coverts white tinged with cream. Bill black. Iris dull red. Feet lead grey. Bill 17-17.5, wing 93, tail 83-86, tarsus 27-27.5, mid toe 22-24 mm. *Adult female* with bill averaging 2 mm. shorter, and plumage more greenish grey and with less olive brown than in *A. m. melanura.*

Status. This subspecies is characterised by the reduction of yellow in the plumage as compared with the mainland form, and so yellowish olive disappears from the under surface and the pectoral plumes and under tail coverts are whitish. Dull violet on the head replaces the bright purple of *A. m. melanura,* and there is less olive on the margins of the secondaries.

Distribution. Three Kings Islands: Great, South-west and North-east Islands. Plentiful.

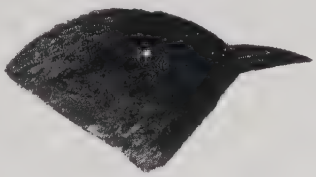
Habits. In his paper on the birds of the Three Kings Turbott writes: "The bellbird is by far the commonest land bird and has been thus noted by Cheeseman and subsequent observers. We would estimate it as outnumbering every other species at present by at least ten to one. Nesting was over by November-December, 1945, but young birds not long out of the nest were quite common. Its diet must be predominantly insectivorous, although *Metrosiderus excelsa* Gaertn. (pohutukawa), and a few other nectar bearing trees would provide a modicum of sweet substance. In May, 1946, in Tasman Valley, bellbirds were feeding from flowers of the rare bignoniaceous liane endemic to the group. In addition to the melodious song both sexes have the same harsh call note, pitched a little higher in the female."

References.—Falla, Rec. Auck. Mus., 3, 337, 1948 (*Anthornis melanura obscura,* Three Kings). Turbott, Rec. Auck. Mus., 3, 333, 1948.

Bellbird. Korimako

Anthornis melanura melanura

Undoubtedly the Bellbird was the chief performer in the chorus described by Sir Joseph Banks in the following words when, with Captain Cook in the *Endeavour,* he entered Queen Charlotte Sound for the first time during Cook's first voyage of discovery.



Margaret A. Morison

BELLBIRD

"17th January, 1770, I was awakened by the singing of the birds ashore, from whence we are distant not a quarter of a mile. Their numbers were certainly very great. They seemed to strain their throats with emulation, and made, perhaps, the most melodious wild music I have ever heard, almost imitating small bells, but with the most tunable silver sound imaginable, to which, may be, the distance was no small addition."

Specimens were collected by Forster and Sparrman in the same locality in 1773 during Cook's second voyage and were first described by Latham in 1782, under the name Mocking Creeper, Latham noticing that the colour on the head was due to a purplish coloured farina, i.e. pollen. Latham did not bestow a specific name, this being done by Sparrman who named the bird *melanura* referring to the dark coloured head. In the North Island the species was collected at the Bay of Islands by Lesson, naturalist of the *Coquille,* in 1824, and again in the same locality by the *Erebus* and *Terror* expedition in 1841. The first specimens to be collected on the Auckland Islands were obtained by the *Erebus* and *Terror* expedition in 1840.

Adult Male. General colour olive-green, changing to yellowish olive on the abdomen and sides of body; forehead, crown and sides of head glossed with deep purple; quills and tail feathers brownish black, the secondaries margined on the outer webs with olive-green; patch on sides of body and under tail coverts pale yellow. Bill black. Iris red. Feet lead-grey, claws brown. Bill 14-15.5, wing 84-92, tail 73-87, tarsus 23-27, mid toe 20-22 mm. *Adult Female.* Smaller than the male and with a faint purple gloss on the forehead and crown only; a narrow white streak from the gape to below the eye. Upper surface olive-brown; quills and feathers dark brown, margined on the outer webs with olivaceous. Under surface yellowish fawn colour; patch on sides and under tail coverts yellowish white. Bill 13-14.5, wing 80-85, tail 70-78, tarsus 24-25, mid to 20-21 mm. *Immature Male.* Similar to adult female but breast and abdomen more yellowish and foreneck and upper breast tinged with fawn colour; a narrow yellowish white line from angle of mouth. The *colour varieties* of the Bellbird so far recorded tend towards canary yellow. A specimen from Akaroa was white, tinged with pale yellow; while an example from Nelson was olivaceous yellow, the quills and tail feathers being greyish. Buller describes a specimen in normal plumage except for the wings and tail which are ashy white, while I have seen a specimen with yellowish white quill feathers.

Kapiti Island *A. S. Wilkinson*

MALE BELLBIRD

Eggs. Clutch three or four, ovoid, pinkish white with reddish brown spots and blotches chiefly at the larger end. 21 x 16.2, 22.5 x 17, 24 x 17 mm.

Distribution. North and South Islands; Poor Knights, Mokohinau, Kawau, Hen and Chickens, Little Barrier, Great Barrier (no recent records), Cuvier Island, Alderman Islands, Mayor Island, Kapiti, D'Urville Island, Chetwode Islands, Stewart Island, Solanders and Codfish Island. More or less common in the larger forested areas of the North Island from Raglan and the Coromandel Peninsula and East Cape southwards, mainly on the ranges from East Cape to Cook Strait and on Mount Egmont. North of this area there are a few Bellbirds near Whangarei, on Kawau Island, in the Hunua Ranges and in some other localities, but they are abundant on the outlying islands listed above. Common throughout the South Island, Stewart Island and the offlying islands. Auckland Islands. Reported by Reischek on the Snares in 1888 as being shy and rare but no later reports.

Ecology. In primeval New Zealand the Bellbird would be found wherever there were Tuis. Its haunts are the same and its food is in every way similar. Furthermore it associates freely with the Tui, the two species often feeding together on the same trees. Its stations are the forests and scrub of the main islands and most of the offlying islets. Like the Tui it performs certain seasonal movements, being, at least in the southern portion of its range, most common in spring near the sea coast. The Bellbird has freely invaded plantations especially where there are eucalyptus and acacia trees, and also the forests of exotic pines at Whakarewarewa, Kaingaroa Plains, Murupara and Golden Downs. According to Sladden Bellbirds are attracted to the forest clearings on Mayor Island in the Bay of Plenty where the exotic gladiolus has become naturalized.

The Bellbird's place in the economy of the forest and of plantations is that of a destroyer of insects and a distributor of pollen and seeds. Often its forehead may be seen sprinkled with the golden pollen of New Zealand flax or the purple pollen of the native fuchsia.

The impact of European culture on the Bellbird at first took the form of a rapid and alarming reduction in the number of birds, especially in the cleared portions of the country, but decreases also took place in forested districts. The disappearance of Bellbirds was most noticeable in the North Island and large areas, the north of Auckland for example, are still mainly without Bellbirds. In 1873 Buller said that the Bellbird appeared to be rapidly dying out, and ten years later Travers said that it seemed to have disappeared from the North Island. In 1889 Hamilton stated that it had almost disappeared from Hawke's Bay and the Seventy Mile Bush. Reischek in the north of Auckland and Best at Ruatahuna told the same story. Stead noted that the Bellbird population was lowest in Canterbury about 1910. After the turn of the century reports generally told of the coming back of the Bellbird. In the last fifty years throughout the whole country it was the same story and now Bellbirds have invaded the settled country and sometimes suburban gardens much to the delight of everyone interested in our wild life. Several causes have been given for the disappearance of the Bellbird. Bees, rats, cats, stoats, weasels, starlings, thrushes, and bush fires have at times been held to be the principal or contributory factors. Perhaps all these agents have had some effect but I should judge that the animal most destructive of Bellbirds was the brown rat which could climb low trees and catch young birds learning to fly when they tumbled to the ground. But rats and other enemies of Bellbirds are still with us so perhaps the Bellbirds themselves have adjusted their habits and built their nests in less accessible places, and so have been able to increase in the presence of numerous European pests. On islands where, as a rule, introduced mammals are few or absent the

Kapiti Island *A. S. Wilkinson*
FEMALE BELLBIRD

Bellbird has, so far as is known, nearly always held its own.

Food. Insects, nectar and fruit form the food of the Bellbird. The bark of trees is thoroughly searched for insects and spiders which are picked out with the Bellbird's brush-like tongue. All kinds of soft fruits are eaten, while nectar is provided by many species of indigenous trees and the New Zealand flax plant (Phormium). The kowhai, rata, rewarewa and fuchsia are favourite and abundant nectar-producing trees while among naturalised plants fuchsia, wattle and blue-gum perhaps furnish the largest supplies of this sweet secretion. Figs, apples, peaches and other orchard fruits are eaten but if harm is done by so doing compensation is paid or partly paid by the Bellbirds consuming insects. In winter when nectar is scarce the Bellbird feeds on insects and native fruits such as coprosma, fuchsia, cabbage tree and others that may be in season. Other kinds of birds freely associate with the Bellbird while feeding on the nectar of flowers. In Stewart Island Tuis and Bellbirds fill the rata trees when in flower, and I have seen Bellbirds, Grey Warblers and Tomtits swarming in the profusely flowering trees of mountain houhere on Flora Saddle at an altitude of 3,000 feet. The small birds were probably feeding mainly on insects.

On the Auckland Islands Waite records that, at the time of his visit, November 1907, Bellbirds were feeding mainly on the flowers of dracophyllum. "The birds also searched the bark of trees and shrubs, ascending much after the manner of a creeper, but they pick off the insects with the sticky tongue." On Ocean Island, in 1927, I saw Bellbirds feeding on the berries of *Nertera depressa.*

Voice. The fame of the Bellbird rests on its remarkable flute-like or bell-like notes and is well deserved. These are usually uttered as a chime of four to six, which, when issuing from numerous birds in all directions, gives a wonderful effect. It was no doubt the Bellbirds' notes which impressed so much Captain Cook and Sir Joseph Banks when in Queen Charlotte Sound in 1770. The variations in the Bellbirds' scale are recorded in Andersen's book, to which reference should be made for information concerning the songs of New Zealand birds. Bellbirds sometimes have regular concerts. I have watched a number assembled in a low tree on the summit of Little Barrier Island, each one contributing to the programme. Apparently the gathering was for the express purpose of singing together, though the notes were not emitted in unison.

Observing the Bellbird in Dunedin over a period of years Marples shows by a series of charts that there is a seasonal period of song activity. Different songs varied in the time of their peak of activity but generally this was in June and July, in one song it was in August, and there was a distinct lessening of or absence altogether of songs in October, November and December, that is, during the breeding season. The Bellbird begins to sing before daylight and about sunrise the greatest volume of song is produced. Singing is continued throughout the day. The song of the female is not so full as that of the male.

Nesting. In the New Zealand forest and scrub the Bellbird's nest is usually built in a tree or shrub, though occasionally it is found in a hole in a tree trunk. This position is, according to Guthrie-Smith, the normal one on Solomon Island off Stewart Island, where a more exposed position would render the nest liable to be destroyed by the fall of petrels, which land nightly in vast numbers during the breeding season. The nest is usually built of twigs, leaves, rootlets and grass and lined with fine grass, moss and feathers. Potts said that the feathers in each nest are usually of one colour, for example, red feathers of the kaka or green of parrakeets. The breeding season extends from September to January during which time two broods may be reared. Incubation is carried out by the female but both parents feed the young which at first are provided with insects. Soon, however, they learn to sip nectar from flowers. Buddle on the Poor Knights found that the chicks were fed on nectar for the first three days and then on insects. Mr. A. S. Wilkinson has kindly informed me that on Kapiti he has observed that the period of incubation is 13 or 14 days, while the young leave the nest after a further fortnight and are fed by the parents for about ten days afterwards.

References.—Sparrman, Mus. Carls., 1, 5, 1786 (*Certhia melanura*, Queen Charlotte Sound). Lesson, Voy. Coquille, Zool., 1, 644, 1830 (*Philedon dumerilii* Bay of Islands). Buller, Birds N.Z., 91, 1872; 2nd ed., 1, 85, col. pl. 1888.; Suppl. 2, 138, 1905. Reischek, Trans. N.Z. Inst., 19, 186, 1887. Andersen, Bird Song, 142, 1926. M'Lean, Emu, 11, 178, 1912. Guthrie-Smith, Mutton Birds, 141, 1914. Stead, Life Hist. N.Z. Birds, 145, 1932. Buddle, Bird Secrets, 19, 1951. Wilkinson, Kapiti Bird Sanct., 77, 1952. Bangs, Proc. Biol. Soc. Wash., 24, 23, 1911 (*Anthornis incoronata*, Auckland Is.). Turbott, Notornis, 5, 175, 1953.

Chatham Island Bellbird

Anthornis melanura melanocephala

This fine subspecies, which represents on the Chatham Islands its smaller ally in New Zealand, was first discovered by Dieffenbach who visited the group in 1839. Buller visited the Chathams in 1855 and obtained a specimen. In 1871, Travers found it on all the islands but mostly on Mangere. About twenty-five years afterwards it was reported as "going fast" by a collector, who shot all he could for monetary gain, and in 1924, Archey and Lindsay failed to find it at all.

Adult. General colour olive-green, lighter on the abdomen and sides; forehead and crown steel-blue, changing to purplish blue on the sides of the head and throat; quills and tail feathers blackish brown margined with steel black. Bill black. Iris yellow. Feet brown. Male: bill 18-25, wing 106-110, tail 107-110, tarsus 34-38, mid toe 25-30 mm. The female is smaller with duller head, rump and under surface. Bill 14-15, wing 90-97, tail 90-95, tarsus 30-32, mid toe 23-26 mm. The *immature* has the upper surface dull yellowish green; faint bluish gloss on head; quills and tail feathers brown with olive green edgings; under surface pale olivaceous yellow; throat buffy white; pale yellowish patch on sides; under tail coverts fulvous yellow.

Eggs. Clutch three, ovoid, pink with large reddish brown blotches at the larger end and smaller ones elsewhere, 26 x 18.5, 25.5 x 19 mm.

Status. The Chatham Island Bellbird differs from the New Zealand form in the larger size of the male, in having more steel blue on the head and in the less amount of yellow in the plumage. There is no yellow patch on the sides. The plumage of the adult male bird is in a more advanced stage than in the adult male of the New Zealand species, where juvenile characters such as the yellow patch on the sides are retained by the adult birds. This relationship is similar to that between the North Island and the South Island Robins, the latter having the more advanced plumage.

Distribution. Chatham Islands. Formerly on Wharekauri (main island), Pitt Island, Mangere and Little Mangere Islands. Extinct since about 1906.

Nesting. The breeding months of the Chatham Island Bellbird are August, September and October, according to Potts, who states also that the nest was built in kopi (karaka) trees where supplejack vines provide some shelter, in karamu bushes, or under the heads of tree ferns. It was placed at a height of about twelve feet above the ground. The only nest that has been preserved is in the Canterbury Museum. It is composed of fine sticks, grass and roots, and lined with grass. Travers noted that the song of the Chatham Island Bellbird was richer and fuller than that of its New Zealand congener.

References.—Gray, Dieff. Travels N.Z., 2, 188, 1843 (*Anthornis melanocephala*); Zool. Erebus and Terror, Birds, 4, col. pl. 1845. Buller, Birds N.Z., 96, 1872. 2nd ed., 1, 92, 1888. Potts, N.Z. Jour. Sci., 2, 279, 1884.

Genus Notiomystis

Bill shorter than head, nostrils operculated. Rictal bristles present. Third to sixth quills longest. Tail rounded, feathers pointed.

A distinct genus, easily recognised by its rictal bristles and pointed tail feathers, and apparently related to Meliphaga of Australia and New Guinea. It comprises a single species confined to New Zealand.

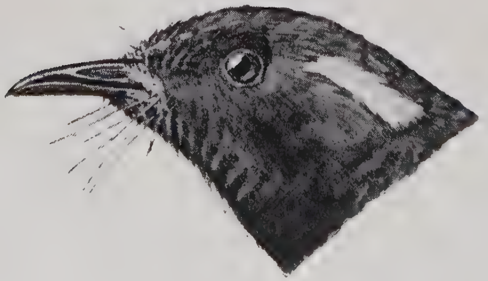
Reference.—Richmond, Proc. U.S. Nat. Mus., 35, 634, 1908 (*Notiomystis, type Meliphaga cincta* Du Bus).

Stitchbird. Hihi

Notiomystis cincta

The first mention of the Stitchbird is a short account by the Rev. W. Yate, published in 1835. Yate lived at the Bay of Islands so presumably Stitchbirds were then present in that locality. The first specimens to be collected found their way to European museums, and in 1839 descriptions were published in France and Belgium. Shortly afterwards, specimens reached the British Museum from Miss Stone and Percy Earl. At that time common throughout the North Island, it has since disappeared everywhere except on Little Barrier Island.

Adult Male. Head, neck and upper part of back velvety black; a tuft of white feathers on each side of the head; a band of canary-yellow across the breast widening at the sides and extending to the small wing coverts; mantle and back blackish brown with yellow edges to the feathers; rump and upper tail coverts olive-brown; wings and tail blackish brown, the feathers edged with yellowish; basal half of some of the secondaries and their coverts white. Breast and abdomen pale yellowish brown with darker centres to the feathers. Bill brownish black. Iris dark brown. Feet light brown. Bill 14.5-16.5, wing 90-105, tail 70-78, tarsus 25-28, mid toe 20-25 mm. *Adult Female.* Upper surface olive-brown, the quills and tail feathers with their outer margins yellowish olive; a white spot on the secondaries; a few feathers marked with white on the sides of the head. Under surface light olive-brown, abdomen pale yellowish brown with dark centres to the feathers. Smaller than the male. *Immature.* Similar to adult female.



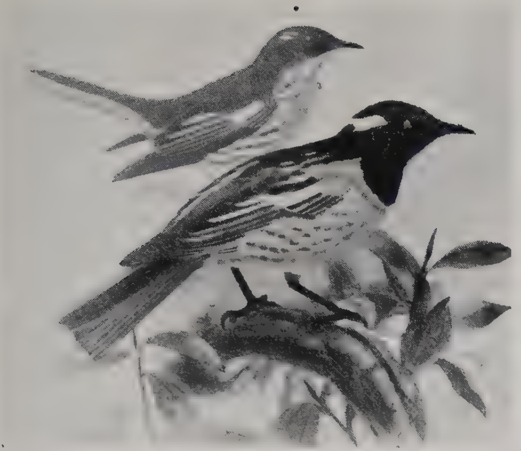
E. H. Atkinson

STITCHBIRD

Eggs. Clutch three to five, ovoid, yellow-white, the whole surface thickly spotted and clouded with pale rufous brown. 19 x 15.4 mm. Kaiwarawara. This description is given by Potts. The measurements are about those of a tomtit's eggs and considerably smaller than would be expected of the egg of a bird the size of a Stitchbird.

Distribution. Formerly throughout the North Island, Little and Great Barrier Islands and Kapiti. Now confined to Little Barrier Island where it is not uncommon.

Ecology. The Stitchbird is an inhabitant of the forest. On Little Barrier Island, its last refuge, it is to be encountered within the forest, sometimes feeding among the undergrowth. In the Urewera country, Elsdon Best states that "natives say that the tieke and tihe birds join flocks of Whiteheads and accompany them; a few will be seen with each such flock." The Stitchbird proved extremely sensitive to European settlement. It was common throughout the North Island from the Bay of Islands southwards before 1840, but a decline in its numbers soon set in. By 1878 none was left north of the lower Waikato. In 1872 Buller stated that it was comparatively common in the southern parts of the North Island, but by 1888 it had become one of the rarest of the native birds. It was ruthlessly sought by collectors though this alone would not ac-



From Buller, Birds of New Zealand
STITCHBIRD

count for its complete disappearance except for a remnant on Little Barrier Island. Possibly it was swept away by a disease.

Food. According to Guthrie-Smith, the principal food of the Stitchbird is nectar. "The hen while sitting is probably fed on it alone, . . . the nestlings were reared on the same ethereal food: the male himself almost exclusively lived on it." Fruits and insects also, according to other observers, form part of the Stitchbird's food.

Voice. The note from which the Stitchbird derives its name is the cry "tee-tee-tee" which it always repeats as its comes round to investigate any intruder into its domain. Besides this cry, Guthrie-Smith heard the male indulge in a low warble.

Nesting. The only ornithologist who has observed the breeding habits of the Stitchbird is Mr. W. H. Guthrie-Smith who spent several months on Little Barrier Island. Five nests were found, three being in large puriri trees from thirty to sixty feet from the ground, one in a taraire about fifty feet from the ground, and one lower down in a tawa. The nests were all built in holes in the branches of the trees and were made of sticks and rootlets lined with finer material including tree-fern scales and a few feathers. "The first nest was discovered late in November," writes Guthrie-Smith. "It was located at arm's length into a puriri limb, which had in former years been smashed by the fall of a neighbouring tree. Immediately overhead on another dead but sound limb rested a mass of Astelia which served as shelter from sun and rain. The orifice almost immediately narrowed, so that a man's hand and arm could not be inserted without widening the hole. The foundation of the nest was composed of sticks. On this base was placed a superstructure of coarse rootlets, then finer rootlets interwoven and intermixed with a very few Robin feathers; lastly the five pure white, glossy eggs were laid on an unmixed bed of brown tree-fern scale." Incubation is carried out by the female which leaves the eggs for a few minutes at intervals of about an hour probably to be fed by the male bird at some distance from the nest. Both parents assist in rearing the young.

Maori. The Stitchbird was used for food by the Maori, it being caught in the same manner as the Bellbird. The yellow feathers from the breast of the male birds were used to ornament cloaks and were highly prized for that purpose.

References.—Du Bus, Bull. Acad. Sci. Brux., 6, 295, 1839 (*Meliphaga cincta,* North Id.). Buller, Birds N.Z., 98, col. pl. 1872; 2nd ed., 1, 101, col. pl. 1888. Reischek, Trans. N.Z. Inst. 18, 84, 1886 Guthrie-Smith, Bird Life, 35, 1925. Sibson, N.Z. Bird Notes, 2, 142, 1947.

Genus Anthochaera

Bill equal to head, curved. Fourth, fifth and sixth quills longest. Tail graduated. Sometimes wattles at gape.

Three species found in Australia and Tasmania.

Reference.—Vigors and Horsfield, Trans. Linn. Soc., 15, 320, 1827 (*Anthochaera,* type *Merops chrysopterus,* Lath.).

Red Wattle Bird

Anthochaera carunculata

The Red Wattle Bird of Australia has been noticed in New Zealand on two occasions only. The first specimen was taken at Matakana about 1865, and the second was obtained at Rahotu by Mr. Avery, when serving with the volunteer expedition against Parihaka, in 1882.

Adult. Forehead and crown dark brown, finely streaked on the crown with white; hind neck, mantle and back greyish brown, streaked with white; upper tail coverts brown with white margins; quills and tail feathers brown, tipped with white. Loral and subocular regions silky white; under surface white, streaked with brown, the centre of the abdomen bright yellow. Bill and feet brown. Iris red. Wattles blood-red. Bill 23, wing 155, tail 165, tarsus 35, mid toe 38 mm. Matakana.

Eggs. Clutch two or three, reddish buff, thickly marked with reddish brown and chestnut spots, 32 x 22 mm.

Distribution. Two occurrences: Matakana, Rahotu.

The southern portion of Australia ranging on the east as far as South Queensland.

Habits. The Red Wattle Bird is usually found in open forest country and moves about a good deal to places where there are eucalypt and banksia trees in flower. In the winter it resorts to scrubs to feed on the banksia flowers. Its food consists of insects and nectar and it takes cultivated fruits. The nest is placed in a shrub or tree up to about fifty feet from the ground and is composed of twigs, grasses and strips of bark and lined with grasses, soft bark and hair.

References.—Shaw, White's Jour. Voy. N.S.W., 240, 1790 (*Merops caruncutatus,* N.S.W.). Buller, Birds N.Z., 2nd ed., 1, 106, 1888. Shufeldt, Emu, 13, 1 1913 (skeleton). Dove, Emu, 11, 43, 1911.

Genus Meliphaga

Bill equal to head, broad at base, slightly decurved, ridged on culmen. Tail square or slightly rounded.

About twenty species in Australia and Tasmania; others in New Guinea, Malay Archipelago and western Pacific. A single species straggling to New Zealand.

Reference.—Lewin, Birds New Holl., 5, 1808 (*Meliphaga,* type *M. lewini* Swainson).

Yellow-faced Honeyeater
Meliphaga chrysops

Major-General Schaw records that in three successive years, 1888-1890, a pair of Yellow-faced Honeyeaters visited Limestone Island in Whangarei Harbour. General Schaw observed the birds carefully and identified them as this species.

Adult. Upper surface brown tinged olive; a black line from the nostrils through the eye; lores and band below eye widening backwards bright yellow; below this a band of black from the lower mandible to beyond the line of the ear coverts; a spot of yellow behind the eye and a spot of white behind the ear coverts. Under surface dark greyish brown. Bill blackish brown; iris dark brown; feet leaden brown.

Eggs. Clutch two-three, pale salmon with reddish chestnut and greyish purple spots mostly at the larger end. 19 x 13 mm.

Distribution. Whangarei Harbour, sight record. Eastern and southern Australia from Cairns to eastern South Australia.

Habits. Common in open forest and scrub where it finds its food, which consists of insects, nectar and soft fruits, among the trees and bushes. It is troublesome to orchardists during the season when the fruit is ripe. Its nest is a cup-shaped structure neatly made of bark, cobwebs and moss and lined with fine grass and roots. It is suspended, not far above the ground, from the smaller branches of a tree or shrub.

References.—Latham, Ind. Orn. Suppl., 54, 1801 (*Sylvia chrysops,* New South Wales). Shaw, Trans. N.Z. Inst., 26, 638, 1894.

FAMILY PHILESTURNIDAE
SADDLEBACK. HUIA

Bill longer than the head, sharp pointed, culmen flattened on the ridge which is wide between the nasal depressions. Nostrils operculated and partly covered with plumes. A fleshy wattle on each side of the gape. First quill reaching more than half the distance between the carpel flexure and tip of wing. Feet long and strong. Tail rounded, the shafts of the feathers projecting as minute points.

There is no doubt that the Saddleback and Huia are closely related, for, besides having the above-mentioned external characters in common, they agree closely in their skeletal features, a conspicuous character being the great backward expansion of the lower mandible beyond its articulation with the quadrate. Altogether their distinctive characteristics warrant their being placed in a family by themselves.

Key to Genera

Black with tip of tail white	*Heteralocha*
Black with lower back chestnut	*Philesturnus*

GENUS PHILESTURNUS

Bill longer than head, stout, straight, sharp pointed, culmen flat on top. Wings short, fourth to sixth quills longest. Feet strong, hind claw longest.

Philesturnus agrees in all essential external and skeletal characters with Heteralocha. Its distinctive features are its smaller size, straight bill the same in both sexes, and the smaller wattles. It is easily recognised by its black colour with conspicuous chestnut back.

There is a single species confined to New Zealand.

Reference.—St. Hilaire, Nouv. Ann. Mus. Hist. Nat., 1, 390, 1832 (*Philesturnus,* type *Sturnus caruncalatus* Gm.).

North Island Saddleback. Tieke

Philesturnus carunculatus rufusater

The North Island Saddleback is doubtless the "starling" that Crozet mentions during his stay at the Bay of Islands in 1772. Specimens were obtained in the same locality in 1824 by Lesson, naturalist to the *Coquille.* Yate in 1835, also at the Bay of Islands, said that the Tieke was very rapid in its motions and exceedingly restless. In 1862 Layard collected the Saddleback on Little Barrier Island.

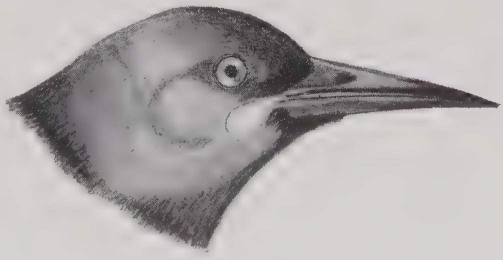
Adult. Glossy black; back to upper tail coverts, wing coverts, and under tail coverts bright chestnut; a pale brown upper edging to the chestnut on the back. Bill and feet black. Iris dark brown. Wattles orange. Bill 28.5-32, wing 98-102, tail 80-90, tarsus 35-40, mid toe 30-37 mm. *Immature.* Brownish black with obscure pale edgings to the feathers; the chestnut parts dull; no light band on back. Wattles small.

Eggs. Clutch two, oval, ground colour very pale brown, blotched all over with brown and pale brown, with concentration at the larger end. 30 x 21.4, 29.8 x 22.5 mm. Hen Island. On Little Barrier Island Hutton found a nest with three eggs, 29.2 x 22.9 mm.

Status The general colour of the North and South Island Saddlebacks is similar but the North Island bird has a distinct pale brown edging along the top of the chestnut saddle; both the bird and the eggs are slightly smaller. Furthermore the juvenile is similar to the adult though duller.

Distribution. Formerly abundant throughout the North Island. Kaitaia, 1878. Cuvier Island, 1878. Great Barrier Island, 1882. Little Barrier Island, disappeared before 1900. Now known on the mainland only in the Raukumara Range, and on Hen Island where it is abundant. Saddlebacks from Hen Island were transferred to Kapiti in 1925 and bred there but they subsequently died out.

Ecology. On Hen Island the Saddleback is found in the taraire and kanuka forests that cover the slopes of the island. Various observers on the mainland when the Saddleback was present recorded a peculiar association with Whiteheads. After the nesting season Whiteheads move about in flocks and the tieke, two or more, usually follow them.



E. Osborne

NORTH ISLAND SADDLEBACK

Percy Smith suggested that the Saddlebacks acted as guardians to the smaller species and quoted the Maori name tieke as meaning a guardian, but W. W. Smith is of opinion that the reason for the Saddleback following the flocks of whiteheads was really to feed on the insects which those birds disturbed or rejected. The North Island Saddleback quickly retreated before the advance of European settlement. By 1870 it had gone from the mainland north of the lower Waikato. In the Urewera district Best, and in northern Hawke's Bay Guthrie-Smith said that it disappeared long before these places were altered by settlement. As Saddlebacks get much of their food from the ground and build their nests low in the forest they and their young would come within easy reach of rats and cats. It is likely that the Saddleback on Little Barrier Island was exterminated by cats left by the Maoris when they were evacuated from the island, and probably others left by European caretakers.

Food. The food of the North Island Saddleback consists mainly of insects, but berries and nectar are also eaten. On Hen Island Saddlebacks are reported as feeding on the fruit of the whauwhaupaku (Sibson) and kawakawa (Lamb). On the same island Wilkinson states that the Saddleback feeds largely on the weta which it digs out from holes in trees. While eating these insects it holds them down with its feet and one was seen holding a weta in its claw, parrot fashion.

Voice. On Hen Island Reischek writes the notes down: *vi, zi, o* twice repeated and followed by *te, te, te, te.* Mrs. Moncrieff on the same island says the alarm note is tit-tee-ta-tee-ta-tee repeated a few times. The early morning song, she states, is monotonous, not strident, and consists of four notes on the same tone, then two higher notes.

Nesting. In 1867 Hutton and Kirk discovered a nest of the Saddleback on Little Barrier Island about two feet down the hollow stem of a dead tree fern. It was composed of filmy fern stems and fibres of nikau palm and lined with manuka bark. More recently several nests have been found on Hen Island. Mrs. Moncrieff in 1927 found nests in a hole in a puriri tree about ten feet above the ground, in a hollow trunk of a kohekohe tree about six feet from the ground, and between a rock and the trunk of a tree. A fourth nest was found by Mr. Pycroft near the trunk of a karaka tree eighteen inches above the ground. All the nests were made of kanuka twigs and lined with grass or feathers or both. According to Reischek, who observed the Saddleback on Little Barrier Island, both the male and female share the incubation of the eggs and the rearing of the young. Two or three eggs are laid. One of the nests found by Mrs. Moncrieff on Hen Island in December contained two eggs and a family party consisting of two adults and three young birds was seen.

Maori. According to Buller, the Tieke was not wilfully killed by the Maori, it being regarded with a degree of superstitious reverence and as a bird of omen. It was supposed to keep guard over ancient treasures, while a war party hearing the call of the Tieke on the right of their path considered it an omen of victory but if on the left it presaged defeat.

References.—Lesson, Man. Orn. 355, 1828 (*Icterus rufusater,* Bay of Islands); Voy. Coquille Zool., 1, 415, col. pl. 1828 (*I. novae zelandiae,* Bay of Is.). Buller, Birds N.Z., 149, col. pl. (adult), 1872; 2nd ed. 1, 18, 1888. Reischek, Trans. N.Z. Inst., 19, pp. 188, 189, 1887. Smith, Trans. N.Z. Inst. 43, 154, 1911. Wilkinson, Emu, 26, 243, 1927; Kapiti Bird Sanct., 82, 1952. Moncrieff, N.Z. Jour. Sci. Tech., 10, 338, 1929.

South Island Saddleback. Tieke

Philesturnus carunculatus carunculatus

The South Island Saddleback was collected by Forster at Queen Charlotte Sound during Cook's second voyage. Forster's specimens were preserved in the Leverian and later in the Vienna Museum but were thrown out after nearly a hundred years on account of their bad condition. Forster observed the two phases of the species but supposed that the brown birds were the females and young. From Forster's drawing and notes, Latham described the "Wattled Stare" and this was adopted by Gmelin when founding the binomial name. The Saddleback was also collected at Queen Charlotte Sound during Cook's third voyage and a drawing of it made by Ellis. When the *Astrolabe* visited New Zealand in 1827, Quoy and Gaimard collected specimens of the Saddleback at Tasman Bay and correctly determined the brown forms to be the young, stating that the male and female adults were both coloured alike.

Adult. General colour glossy black; back, upper wing coverts and upper and lower tail coverts bright chestnut. Bill and feet black. Iris dark brown. Wattles orange. Bill 34-36, wing 95-105, tail 95-97, tarsus 38-40, mid toe 32-34 mm. *Immature.* Dark brown above, paler below, tinged with chestnut on the back, wings and upper and under tail coverts. Wattles small, pale yellow. Bill black except edge of basal portion of lower mandible which is yellow. Juvenile birds changing to adult show mixed plumage on the parts that are chestnut in the adult. According to Guthrie-Smith the Saddleback reaches maturity in the second season, but Stead thought that some of the birds might take three years to attain adult plumage. *Colour Variety.* A partial albino is recorded by Buller.

Eggs. Clutch two or three, ovoid, pale grey with dark and pale brown blotches all over, but mostly at the larger end. 30 x 22, 29 x 20, 30 x 20.6, 32 x 22.5 mm. Solomon Island. 32 x 23.5 mm. South Island. 30.5 x 21.6 mm. Westland.

Islands off Stewart Island *E. F. Stead*
SOUTH ISLAND SADDLEBACK

Islands off Stewart Island *E. F. Stead*
SOUTH ISLAND SADDLEBACK

Status. The absence of a distinct brown edging at the top of the chestnut saddle and the differently coloured young sufficiently characterise this subspecies.

Distribution. Formerly throughout the South Island from Stephen and D'Urville Islands to Stewart Island and its offlying islets. There are no recent records from the South Island or Stewart Island. Common on three of the islets off the south-west coast of Stewart Island.

Ecology. The forest interior both among the trees and on the ground is the proper station of the Saddleback. It is a noisy, active bird progressing by what may be described as long hops or short flights. It appears on the scene to the accompaniment of its shrill note, moves restlessly about for a few moments and disappears as quickly as it came. Reischek found it only on the high ranges, but its present strongholds are now at sea level on offlying islands. It was generally encountered in groups of four or five together, probably family parties, but in the winter time it was gregarious and was then often seen following flocks of yellowheads. Like its northern congener the South Island Saddleback vanished as the country was deforested. In the present century it has been reported in only a few localities. But the clearing of forest alone would not account for the disappearance of the Saddleback as there are still large areas under forest, and it was reported as dying out in Westland before the introduction of stoats and weasels. This may mean little as rats and cats would have invaded the forest long before the other animals were introduced. In the last two decades of the nineteenth century there was a considerable trade in the skins of Saddlebacks and other peculiar New Zealand birds with European museums. But all these causes do not satisfactorily account for the almost complete disappearance of the species. Only on the isolated islets off Stewart Island, comparatively safe from predatory animals and disease, has the South Island Saddleback survived.

Food. The food of the Saddleback consists mainly of insects, but fruit and nectar from flowers are also eaten. It feeds among the trees within the forest interior, using its strong chisel-like bill to loosen bark and chip away decaying wood. It also feeds on the ground, where, in dead logs, it finds the huhu grub, the larva of a large beetle.

Nesting. Usually the nest is fairly low down, those found by Guthrie-Smith on Solomon Island being from a few inches to about twelve feet above the ground. The nests are composed of a base of rootlets and fern leaves on which rests dracophyllum leaves, with the cavity lined with tree-fern scales. During November Guthrie-Smith found two eggs or two young birds in each nest and there were nests being built. The period of incubation was ascertained to be twenty or twenty-one days. The rearing of the young was carefully studied by Guthrie-Smith on Solomon Island. Almost exclusively a soft white grub, dug up by the parents beneath tall clumps of fern, was fed to the nestlings. A nest from Okarito in the Canterbury Museum is made of grass-like leaves, some recognisable as carex. Interwoven are a few twigs of rimu. The lining is of finer grass-like leaves, rimu twigs and mossy liverworts. E. F. Stead found nests on Solomon Island in holes in trees or banks, and among hanging leaves of tree ferns. He states that nesting lasts from late October until the end of December, while after watching a family party of a bird in adult plumage, a bird in juvenal plumage and a yearling, he thought that occasionally a bird breeds in immature plumage.

References.—Gmelin, Syst. Nat., 805, 1789 (*Sturnus carunculatus,* Queen Charlotte Sound). Quoy and Gaimard, Voy. Astrol. Zool., 1, 212, col. pl. 1830. Buller, Essay N..Z Orn., 10, 1865 (*Creadion cinereus,* Banks Peninsula); Birds N.Z., 149, col. pl. (young), 1872; 2nd ed. 1, pp. 18, 21, col. pl. 1888. Potts, Trans N.Z. Inst., 5, 184, 1873. Smith, Trans. N.Z. Inst, 21, 218, 1889. Guthrie-Smith, Bird Life, 156, 1925. Stead, Trans. Roy. Soc. N.Z., 66, 185, 1936.

GENUS HETERALOCHA

Bill long, acutely pointed, the male arched, the female much longer and more curved. Fifth to seventh quills longest. Tarsus long and strong, hind claw much larger than the others.

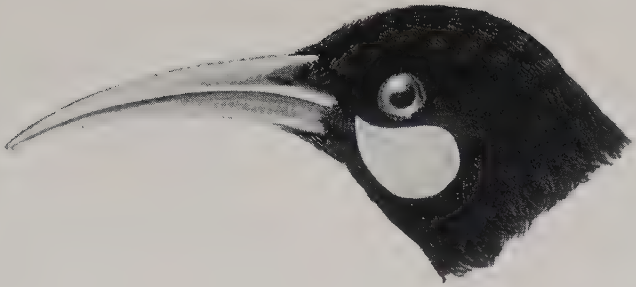
Heteralocha contains a single species formerly found in the North Island of New Zealand, and distinguished by the different bill in the two sexes. Its only close ally is Philesturnus which differs in the bill being alike in both sexes and in the relatively smaller wattles. Garrod stated that the Huia was intimately related to the Sturnidae, mentioning among other characters that in the starling the angle of the mandible was slightly prolonged backwards. There is however a considerable difference between the starling and the huia in the form of the vomer and maxillo-palatines.

Reference.—Cabanis, Mus. Hein., 1, 218, 1850 (*Heteralocha,* type *Neomorpha acutirostris* Gould).

Huia

Heteralocha acutirostris

The Huia is mentioned by Yate in his *Account of New Zealand,* published in 1835. The description given is at fault in several particulars, but the value attached to the tail feathers by the Maoris is mentioned. The same year as Yate's book appeared, two damaged specimens, a male and a female lacking the feet and most of the wings, were obtained by the captain of a



MALE HUIA

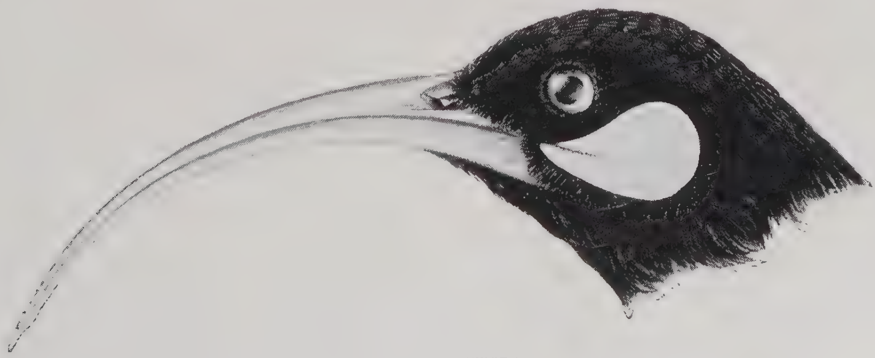
vessel from a Maori chief and taken to England. These specimens were forwarded to the celebrated ornithologist, John Gould, and were by him described as two distinct species distinguished by the differences in the bills. Dr. Dieffenbach, naturalist to the New Zealand Company, obtained specimens in the Wainuiomata Range about 1840 and these were figured by Gould in his great work on the birds of Australia.

Adult Male. Bill stout, arched, shorter than the tarsus. General colour black with a greenish gloss; a broad white band across the tip of the tail. Bill ivory-white. Wattle orange. Feet bluish grey, claw horn colour. Bill 57-60, wing 210-220, tail 200, tarsus 84-86, mid toe 56-62 mm. *Adult Female.* Similar to male. Bill slender, strongly curved, 85-88, wing 200-202, tail 195-200, tarsus 77-78, mid toe 55 mm. *Immature.* Plumage suffused with brown; under tail coverts tipped with white; terminal white of tail washed with rufous yellow. *Colour Varieties.* Buller refers to an albino which Mr. Drew of Wanganui had seen. He also describes a brownish black specimen banded with grey.

Eggs. Clutch two to four, stone grey with markings of rounded spots and dots of dark purplish grey and brown. 45.7 x 27.9 mm. Rimutaka Range.

Distribution. North Island. Rimutaka, Tararua, Ruahine and Kaimanawa ranges and perhaps further north on both sides of the island. No reports of its existence since about 1907.

Ecology. According to Buller, "the Huia never leaves the shade of the forest. It moves along the ground, or from tree to tree, with surprising celerity of bounds or jumps. In its flight it never rises, like other birds, above the tree-tops, except in the depth of the woods, when it happens to fly from one high tree to another. . . . They are generally met with in pairs, but sometimes a party of four or more are found consorting together."



FEMALE HUIA

The forests on the mountain ranges where the Huia was found are in large part beech (Nothofagus) but, especially in the valleys, mixed podocarp forests with denser undergrowth occur. The Huia was usually found in rough mountainous country, but Colenso records the fact that a Maori caught six birds in a karaka grove near the sea-coast at Cape Turakirae. It is said to have frequented the ranges in summer and in winter to have moved to the lower levels.

It is almost certain that the Huia is now extinct, though there are considerable areas of forested country where a few birds could still exist. There have been no reliable reports of it having been seen since W. W. Smith saw two males and a female on December 28th, 1907. No one has claimed that the disappearance of the Huia was due to deforestation or introduced mammals. As early as 1845 Gray said that the Huia was apparently becoming scarce and would probably soon be exterminated. It is a regrettable fact that the Huia became an object of trade both by the Maoris and the Europeans. The Maoris, however, would never have exterminated the Huia but for gain of money from European collectors. Large numbers were taken for sale to European museums during the last decades of the nineteenth century, and the final act took place in 1902 when a raid was made on them for their tail feathers. The story is that when the Duke of York visited Rotorua one of the Maori guides placed a Huia's tail feather in his hatband. This caused such a demand to wear these feathers that the price went up to a pound each, and the Huia succumbed.

Food. The food of the Huia consisted of insects, spiders and fruits. Insects were obtained under bark, in decaying logs and on the ground. The powerful beak of the male bird enabled it to tear off pieces of bark and chisel away soft wood so as to obtain hiding insects and their larvae. Such fruits as the hinau, porokaiwhiria, pokaka and karamu were eaten.

The different uses that the beaks of the male and female Huias were put to seems first to have been described by Buller. It will be fitting, therefore, to quote his own words. "But what interested me most of all was the manner in which the birds assisted each other in their search for food, because it appeared to explain the use, in the economy of nature, of the differently formed bills in the two sexes. To divert the birds, I introduced a log of decayed wood infested with the huhu grub. They at once attacked it, carefully probing the softer parts with their bills, and then vigorously assailing them, scooping out the decayed wood till the larva or pupa was visible, when it was carefully drawn from its cell. The very different development of the mandibles in the two sexes enabled them to perform separate offices. The male always attacked the more decayed portions of the wood, chiselling out his prey after the manner of some woodpeckers, while the female probed with her long pliant bill the other cells, where the hardness of the surrounding parts resisted the chisel of her mate. Sometimes I observed the male remove the decayed portion without being able to reach the grub, when the female would at once come to his aid, and accomplish with her long slender bill what he had failed to do. I noticed, however, that the female always appropriated to her own use the morsels thus obtained."

A similar instance of the birds helping each other to obtain wetas, this time from living wood, is recorded by J. M. Wright, who says: "I have watched them in pairs hunting for wetas. The male would tear away the outer part of a green sapling. The female then tried to retrieve the weta with her long slender bill. If not successful she would stand back while the male tried to enlarge the hole. Unless the tree was a maire the birds would generally succeed, and would then fly away with the weta."

Voice. When feeding, the Huia utters a quick soft whistle. The cry of alarm, however, from which the Huia obtains its name, is a shrill whistle repeated many times. The birds could always be attracted by one or other of these calls.

Nesting. Very little is known of the breeding habits of the Huia although the species was fairly common quite close to Wellington. Only a few nests and two eggs have been described. The site is given by several observers as on or near the ground, usually at the foot of a large tree; on a covered ledge in an old rata tree; in a depression formed at the top of a truncated tree and sheltered by a mass of overhanging growth. Potts collected a nest, now in the Canterbury Museum, near the Manawatu River. It had a base of astelia leaves and a few sticks. On this was built the sides of quite large sticks and astelia leaves, the lining being finer material of the same kinds. The diameter of the nest was about fourteen inches, the cup was nearly seven inches across and two and a half deep. Potts writes as follows regarding the Huia: "It breeds during the months of October and November, placing its large nest in a hollow tree. Not far from the Manawatu River a nest was found in a large hollow tree, about 18 feet from the ground. It contained a solitary young bird which was taken with the nest, and successfully raised by being fed on the larvae of a large beetle, *Prion reticularis.* . . . I have a note of another nest with three young birds, it was also found about two miles back from the Manawatu River, in the month of November. The young accompany and feed with the old birds for a considerable time, as little flocks of four or five birds are sometimes met with actively engaged in stripping mosses and parasitic ferns from boughs and branches in their insect search."

Maori. By the Maori the tail feathers of the Huia were highly prized, and were worn by chiefs in the hair. They were sent long distances either as barter or to chiefs executing tributary authority over the tribes living near the range of the Huia. The skins of Huias deprived of their feet and wings were also worn as ornaments attached to the ears. Elaborately carved boxes called waka huia were used to keep the Huia's feathers in.

The Maoris attracted the Huia by imitating its call and then with the aid of a long rod, slipped a running knot over the head of the female. The male was then easily caught in the same manner. The subsequent preparation of the skin is thus described by J. D. Enys. "The bird is skinned, leaving both mandibles as well as the wattles attached, but both wings and legs removed. The skin is then stretched by three small sticks, placed one above the other, and stuck on a forked stick inserted in the ground in front of a fire, the inside of the skin is turned towards the fire so as to dry the skin ready for packing; the tail is carefully bent back behind so as not to dirty the white tips of the feathers. When dried, the under sides of the quills of the tail feathers are cut away carefully, so as to render the feathers more flexible. A piece of totara bark about two feet long and five feet wide, is prepared and bent double in the middle, the ends being rounded off. The dried skins with the tail feathers bent back over the back as dried are placed between these thin pieces of bark and are then ready for being sent away to the Waikato and Taupo country, where they are most valuable articles of exchange."

References.—Gould, Syn. Birds Austr., 1, pl. 2, 1837 (*Neomorpha acutirostris*). Buller, Birds N.Z., 63, col. pl. 1872; 2nd ed., 1, 7, col. pl. 1888; Suppl., 2, 154, 1905. Potts, N.Z. Jour. Sci., 2, 475, 1885. Garrod, Proc. Zool. Soc., 1872, p. 643 (Anatomy).

FAMILY CALLAEADIDAE. KOKAKOS

Bill stout, short, strongly arched, blunt pointed. Wattles at gape. First primary reaching more than half-way to tip of wing.

Related to Philesturnidae but differing in the short, blunt bill. Comprises a single genus of two species confined to New Zealand. The Australian Struthidea is similar in bill and wing characters but lacks wattles.

GENUS CALLAEAS

Bill with a wide nasal depression, the ridge of the culmen narrowing behind. Fifth to seventh quills longest. Tail graduated, the feathers ending in small points. Hind claw longest.

Key to Species

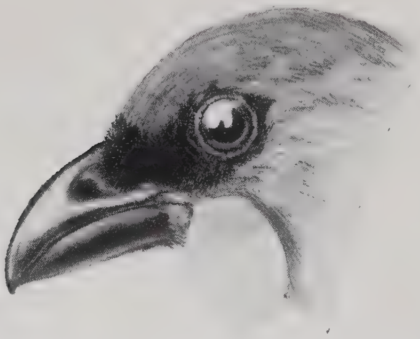
Wattles blue	*C. wilsoni*
Wattles orange blue at base	*C. cinerea*

Reference.—Forster, Enchiridion, 35, 1788 (*Callaeas,* type *Glaucopis cinerea,* Gmel.) Oliver, Emu, 45, 147, 1954 (palate).

North Island Kokako
Callaeas wilsoni

The first mention of the North Island Kokako that I can trace is that of Yate in 1835. Yate states that it was called by some the New Zealand Crow and that it was found in the greatest numbers in the woods on the banks of the River Thames. There is a specimen in the British Museum collected by Miss Stone on the Hokianga River, probably about 1840. Gray seems to have given this the manuscript name of *Callaeas wilsoni,* but it was Bonaparte who actually published it in 1850.

Adult. Dark bluish grey; lores and base of bill velvety black, with ashy grey edging; quills and tail slaty black; lower abdomen tinged with brown. Bill and feet black. Iris dark brown. Wattles bright blue. Bill 24-30, wing 160-180, tail 170-195, tarsus 63-67, mid toe 50-55 mm. *Immature.* Similar to adult, bluish grey generally, wings darker and brownish grey. Lores velvety black, this colour not extending to the eyes. Inside of mouth fuchsia red. (McKenzie.) *Nestling.* A little dark brown down on back, above each thigh and on top of head. Wattles small, pinkish lavender. As the nestlings grow the wattles develop a bluish edge, then they become pinky blue. Inside of mouth purplish pink. (McKenzie.) *Colour Varieties.* Several albinos of this species have been obtained in the Rimutaka Mountains and in the Wairarapa district. Some are pure white, others white with cream-coloured under surface, and others exhibit colours between white and the normal colour such as pale slaty grey or ashy grey. A partly white and partly slaty grey bird was seen in the ranges near Paeroa by H. L. Morgan, 1954.



Lily A. Daff

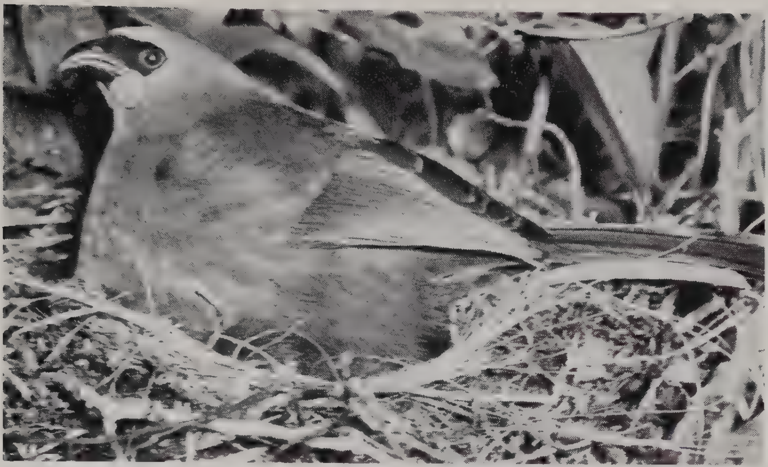
NORTH ISLAND KOKAKO

Eggs. Clutch two or three, ovoid, pale stone-grey, speckled with purplish grey, 35 x 27 mm. A similar egg from the Rimutaka Range, measuring 36.8 x 26.7 mm. was at first referred by Buller to the Huia. A greyish white egg with dark and light brown spots, and measuring 36 x 26.5 mm. was collected by H. S. Munro on November 22nd, 1887, in the Hunua Ranges.

Status. The principal distinguishing character of this species is the blue colour of the wattles. Other features are the ashy grey border to the velvet black of the face, the browner colour of the plumage and the slightly larger size.

Distribution. Formerly throughout the North Island from Hokianga southwards. Bay of Islands, 1900. Great Barrier Island 1868. Tararua Range 1908. Now present in several localities south of Auckland isthmus. Recent records are Hunua Range, Coromandel Range, Rotorua district, Bay of Plenty, Mount Pihanga, East Cape district, Mount Egmont.

Ecology. A tolerably complete account of the habits of the North Island Kokako has been published by M'Lean who observed the species in the Maungahaumia Range in the East Cape district. The birds were found in the lower valleys of tawhero forest but occasionally visited the denser tawa bush. Their movements are thus described by M'Lean. "By means of these long legs they actually swing themselves from branch to



Moumoukai *W. P. Mead*

NORTH ISLAND KOKAKO

branch at times, and very rarely use their wings as a means of locomotion. In moving through the bush they simply run—using the wing to balance—in great bounding hops through the interlacing branches, and in this way can move at a greater pace above than one can walk below. It is doubtful if the crow is able to make any sustained flight, and on the only occasion that I have seen an attempt made, when a party dropped across a creek—a distance of about forty yards—to the opposite face, the wings were hardly moved, and the tips of the primaries were much separated, so they floated rather than flew."

The North Island Kokako retreated as the forest was cleared by Europeans. It had gone from North Auckland by about 1900. Its enemies are said to be rats, stoats and opossums. Its numbers were noticeably reduced in the Raetihi district during the bush fire of 1918. It is quite friendly to man and should maintain itself in the forest areas where it now exists provided it can defend its nest against marauding mammals.

Food. The food of the North Island Kokako consists of young leaves, fruit and insects. When feeding, one foot is constantly brought into use to hold the plant that the bird is eating. The fruit of the kanono (*Copromsa australis*), supplejack and hinau are mentioned by M'Lean who continues: "It is evident that their food, in winter at least, consists to some extent of leaves, for in the scrub below the slip hardly a berry existed, and the pairs that wintered there were, whenever seen by the writer, busy eating the foliage of the puka and of one of the smaller coprosmas (*C. lucida*)."

Other kinds of berries eaten by the North Island Kokako are tataramoa, kaiwhiria and porokaiwhiria (pigeonwood).

Voice. All the notes of the North Island Kokako were carefully recorded by M'Lean who describes them as sharp piping whistles, bell-like, soft musical tapping, sharp clicking, low whistle, sucking note, long organ and clear organ-like. In M'Lean's opinion "there is in our present-day New Zealand bush no bird whose music, when heard in concert with others of its species, surpasses that produced by our sombre-plumaged crow. Few sounds are so enchanting as when a party of these birds is practising a number of rich flute and organ-like notes, many as if in chord, and some ventriloquial. It is only at early morning, when the sun first tips the trees that such a combination may be heard, for then the clicking and tapping sounds of other tunes are not indulged in."

Nesting. When the first edition of this book appeared (1930) very little was known about the breeding habits of the North Island Kokako other than a few remarks made by Reischek who found a nest made of branches, ferns and moss in a clump of astelia about thirty feet from the ground. In the Gisborne district M'Lean described a nest which he considered belonged to this species as a roughly built structure composed of sticks, rootlets, moss and leaves, and lined with manuka bark worked in with moss, leaves and rootlets. In the Hunua ranges the North Island Kokako has been known to exist for many years and recently H. R. McKenzie and other ornithologists watched this locality closely for about ten years, and for this they were amply rewarded on December 2nd, 1950, by finding a nest with three chicks a few days old. The nest was placed in a tawa tree and was 26 feet from the ground. It was less than two feet from the trunk of the tree and when the first man climbed the tree he found himself within two feet of the nest. But the lovely gentle bird that sat in it was not disturbed. She left the nest only when the climber touched her tail and then she waited two feet above the nest until he descended when she covered the chicks. McKenzie thus describes the nest: "The main platform, placed on a firm spreading side branch, was made of rough dry twigs which protruded irregularly all round. The maximum length of sticks was 23 inches. Tawa, mahoe, putaputaweta, pigeon wood, wineberry and supplejack were represented. On the top of this platform, but about the centre only, was placed a layer of rotten wood. The sides were a mixture of small rata vine, leaf fibre of kiekie, much moss, a little lycopod and filmy fern. The cup above the decayed wood was composed of a thick layer of moss which was almost free of the base of sticks. The final lining was a thick loose felting of punga scale. The measurements were: outside width 22 inches, diameter of cup 6½ inches. The whole structure was loosely built and untidy and by the time it was deserted by the chicks it was a flattened wreck." The chicks left the nest on December 27th when 27 or 28 days old. While in the nest they were fed mostly on

Moumoukai *W. P. Mead*

NORTH ISLAND KOKAKO NESTLINGS

berries, the parent usually bringing three at a time. Green fruit of the kanono (*Coprosma australis*), and chewed leaves of pigeon wood (porokaiwhiria) were recognised. A nest found in the same locality by H. S. Monro on November 22nd, 1887, had two eggs and a newly hatched chick. A nest with three eggs was found in the Hunua range in December, 1952. The eggs were laid between December 6th and 11th. They were later destroyed, probably by a stoat which was trapped. Nests with young have been found in January so we may conclude that the egg-laying period is November and December. Reischek records a nest with young, in the Tokatea Range, in early April, 1880. This was probably a late nest caused by some disturbance of one built earlier in the season.

References.—Bonaparte, Comp. Gen. Av., 1, 368, 1850 (*Glaucopis wilsoni*). Buller, Birds N.Z., 152, col. pl. 1872; 2nd ed., 1, 1, col. pl. 1888; Suppl., 2, 166, 1905. Reischek, Trans. N.Z. Inst., 19, 190, 1887. M'Lean, Emu, 11, 229, 1912. McKenzie, Notornis, 4, 70, 1951; 5, 174, 1953.

South Island Kokako

Callaeas cinerea

This is the Wattle-bird of Captain Cook and was discovered at Dusky Sound in 1773. Forster noted that it frequented the ground as well as the trees, that it had a piping voice and lived on fruits and insects. Latham using Forster's material called it the "Cinerous Wattle-bird," hence the specific name adopted by Gmelin. The species was obtained at Tasman Bay by Quoy and Gaimard in 1827 and at Ship Cove, Queen Charlotte Sound, by Dieffenbach in 1839.

Adult. General colour dark bluish grey; lores and base of bill deep velvety black; quills and tail slaty black. Iris dark brown. Bill and feet black. Wattles orange, blue at the base. Bill 30-33, wing 160-170, tail 170-190, tarsus 60-68, mid toe 48-55 mm. *Nestling.* Partially covered with slate-coloured down, under surface bare; bill flesh-colour; wattles pink. *Colour Variety.* A partial albino was obtained by H. H. Travers on Mount Franklin in 1869.

Eggs. Clutch two or three, elongate, ovoid, warm stone colour, with purplish and brown spots and blotches, 40 x 27 mm. Paringa River. 47 x 27 mm. Hokitika River.

Status. Smaller than the North Island Kokako, with no ashy grey edging to the jet black on the face, and with orange instead of blue wattles.

Distribution. South Island. Stewart Island. Perhaps always irregular in its distribution. Now restricted to comparatively few forested areas from Nelson to Stewart Island.

Ecology. The dense damp forest of Stewart Island, the beech forests of the mountainous districts of the South Island and the low scrub above the forest limit are alike the habitat of the South Island Kokako. It is very active, progressing by long hops along the ground or from branch to branch, but its powers of flight are limited. In its movements it is, indeed, not unlike the saddleback and huia, species to which it is obviously related. The replacement of forest by open country was clearly the main reason for the disappearance of the South Island Kokako from large areas of the South Island. Contributing causes were semi-domesticated animals such as dogs and cats, and the ever industrious collector who sold large numbers of specimens to European museums. In 1889 W. W. Smith said that the species was rapidly approaching extinction. By the end of the century it had gone from many localities where it was once plentiful. Now it is seldom seen.

Food. The Kokako's principal food which it takes while in trees and on the ground consists of leaves and herbaceous plants, to which are added various fruits when in season. When feeding, it holds its food with one foot. It is fond of the leaves of the karamu (*Coprosma lucida*) and of the sow thistle and other soft-leaved herbs, trees and ferns, and it is known to have eaten the fruits of the konini and tutu.

Voice. A variety of musical notes is uttered by the South Island Kokako. The usual call is a long plaintive double note;

others are described as flute-like, organ-like and like the bell toll of the tui. "During the breeding season," states W. T. L. Travers, "its song is one of the most varied and beautiful of all the New Zealand birds."

Nesting. The South Island Kokako builds in trees, placing its nest at heights up to twenty feet above the ground. Reischek found nests in thick scrub near the ground. A nest discovered by Potts at Milford Sound had a foundation of sticks on which was placed sphagnum moss containing a cavity lined with grass. It was a large structure built on a foundation about twenty inches across, the remains of an old nest, and was placed in a totara tree overhanging a deep gully. The new nest was about a foot in diameter.

The eggs are laid in December and January and the young are full grown in May. According to Reischek they remain with their parents until the following breeding season.

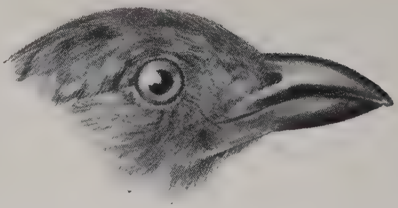
References.—Gmelin, Syst. Nat., 363, 1788 (*Glaucopis cinerea,* Queen Charlotte Sound). Quoy and Gaimard, Voy. Astrol. Zool., 1, 217, col. pl. 1830. Buller, Birds N.Z., 155, col. pl. 1872; 2nd ed., 1, 5, col pl. 1888; Suppl., 2, 164, 1905. Potts, Trans. N.Z. Inst., 6, 145, 1874. Campbell, Trans N.Z. Inst., 12, 249, 1880. Reischeck, Trans. N.Z. Inst., 18, 106, 1886.

FAMILY TURNAGRIDAE

Bill stout, notched at tip. Mouth bristles distinct. First primary more than half the length of the second. Tail feathers 12. Tarsi scutellate. Plumage of young not spotted.

Includes only the New Zealand piopios or thrushes which differ from the true thrushes (Turdidae) in the stout compressed bill, presence of mouth bristles, long first primary and plumage of young not spotted.

The palate of the piopio differs essentially from that of the true thrushes, and also from that of the thickheads (*Pachycephala*) with which Turnagra has recently been allied. The maxillo-palatines meet in front of the vomer as they do in the Australian Magpie (*Gymnorhina*) and the Manucode (*Manucoda*). Accordingly I have removed the family Turnagridae from the neighbourhood of the thrushes. In 1875 Finsch placed *Turnagra* with the bower birds, a much better position than with the thrushes.



Lily A. Daff

NORTH ISLAND PIOPIO

GENUS TURNAGRA

Bill stout, deeper than wide at base, arched. Fifth and sixth quills longest, first about two-thirds the length of the second.

Key to Species

Throat white	*T. tanagra*
Throat olive streaked with rufous	*T. capensis*

Reference.—Lesson, Compl. Oeuvres Buff., 8, 216, 1837 (*Turnagra,* type *Tanagra capensis* Sparrm.) Oliver, Emu, 45, 147, 1945 (palate).

North Island Piopio

Turnagra tanagra

Although the North Island Piopio was at one time said to be common in the southern portion of the North Island, it was not described until 1865 when Schlegel characterised it as a new species from an unknown locality. Buller described it under another name in 1869. In the first edition of his work Buller stated that he had shot a specimen in the Kaipara district in 1852. Like its southern relative it soon began to decrease in numbers and by 1892 was reported as all but disappeared. The last definite record of its occurrence pertains to four specimens in the Dominion Museum obtained at Waitotara in 1887. Writing in 1909, Elsdon Best stated that there were said to be some in the Parahaki district. More recently there have been several reports of Piopios having been seen, chiefly in Taranaki and the Wanganui River districts.

Adult. Upper surface olive-brown; tail feathers and their coverts bright rufous, the two central ones tinged with olive-brown. Throat white; breast olivaceous grey; abdomen yellowish white; sides olive-brown, washed with yellow. Bill and feet dark brown. Iris yellow. Bill 20-23, wing 128-132, tail 120-126, tarsus 32-38, mid toe 30-32 mm. *Immature.* Similar to the adult, but rufous spots on the top and sides of head, a rufous pectoral band, wing coverts tipped with rufous; grey of under surface darker.

Status. Distinguished by its unstriped under surface and, in the adult, absence of rufous on the top of the head.

Distribution. North Island; formerly in all forested regions, though rare to the north of Auckland. Now probably extinct, though recent sight records claimed are inland from Patea, Te Araroa, Wairoa and Wanganui River.

Habits. Nothing seems to have been recorded regarding the habits of the North Island Piopio except the observations contained in Buller's publications. It inhabited the forest, especially the undergrowth and did not take long flights. Insects, worms and berries constituted its principal food. The ordinary note of the Piopio whence it received its name, was a short, sharp whistling cry, quickly repeated. Its song consisted of five distinct bars, each of which was repeated six or seven times in succession, but a variety of other notes was introduced.

References.—Schlegel, Ned. Tijd, Dierk., 3, 190, 1865 (*Otagon tanagra*). Buller, Ibis, 1869, p. 39 (*Turnagra hectori*); Birds N.Z., 135, col. pl. 1872; 2nd ed., 1, 26, col. pl. 1888. Mead, Notornis, 4, 3, 1950.

South Island Piopio

Turnagra capensis

Formerly the Piopio was exceedingly abundant in forests throughout the South Island. Forster procured it at both Dusky Sound and Queen Charlotte Sound in 1773 during Cook's second voyage, and one of his specimens was reported as being in the Vienna Museum in 1873, just one hundred years afterwards. Sparrman, who first described the species, joined Cook's expedition at the Cape of Good Hope, and unfortunately mixed the labels of his specimens with the result that the New Zealand bird received the title *capensis.* In 1827 Quoy and Gaimard, the naturalists on the *Astrolabe,* obtained the Piopio in the forest near French Pass, noting that it did not make long flights. In the early gold digging days on the West Coast it was a common bird in the camps, but by 1870 it was reported to be fast disappearing everywhere. At Lake Brunner, 1889, it was reported as fairly numerous but now it is very seldom seen. Recently, 1949, it was stated that two Piopios were seen at Lake Hauroko in southern Fiordland, and two at Caswell Sound.

Adult. Upper surface olive-brown, forehead striped with rufous; upper tail coverts and tail bright rufous, the two middle feathers and the apical margins of the rest olive-brown tinged with rufous; wing coverts tipped with rufous. Throat and sides of neck striped with rufous; under surface olive-brown broadly streaked with yellowish white; the abdomen and flanks tinged with yellow. Bill and feet dark brown. Iris yellow. Bill 18-20, wing 128-133, tail 128-130, tarsus 30-38, mid toe 27-32 mm. *Immature.* Similar to adult but more rufous on the forehead, sides of head, throat and upper wing coverts.

Eggs. Clutch two, ovoid, white, spotted and blotched with dark and light brown, forming a zone at the larger end and scattered spots elsewhere, 32.5 x 25.5, 35 x 25 mm.

Status. Recognised by its striped under surface which differs conspicuously from that of *T. tanagra.* The specimens from Stephen Island that have been preserved, four altogether, have the wing and tail shorter than in birds from the mainland and have been described by J. H. Fleming as a separate subspecies, *Turnagra capensis minor.*

Distribution. Stephen Island. South Island. Formerly everywhere abundant in the forested areas but now rare, being found only in the south-west portion of the South Island and west Nelson.

Habitat. The South Island Piopio is now so scarce that it is seldom seen. All accounts of observers, when it was fairly common, agree in stating that its favourite haunts were the forest and scrub in the valleys. It could be found, says Potts, in "any bushy place not too far from water." Further, Potts says, "The habitat ranges from the coast to the alpine country." W. W. Smith describes it as a powerful flier and states that it flies with great precision through the forest.

The Piopio was of a friendly nature and would enter the tents of bushmen, looking for scraps of food. On Resolution Island Henry stated that one came into his house and became very tame, hopping about the breakfast table eating crumbs of bread and fish. No doubt the confiding nature of the Piopio, in the presence of dogs, cats and stoats introduced by Europeans, was one of the main causes of the rapid reduction of its numbers as the country became settled.

Food. The food of the Piopio consists of insects, spiders, seeds and fruits. Henry, writing from Resolution Island, said: "They live mostly in the bottoms of warm valleys where the fruit bearing scrubs are most plentiful. I have often seen them eating fuchsia berries, and the Thrush at my house cleared the place of spiders and could shell oats like a sparrow."

Voice. Potts describes the various notes of this species in the following terms: "Its morning salute is a long-drawn rather plaintive note; this particular whistle it indulges in at times only, for its habit, when close to the water, frequently, is to pipe thrice in a way that at once recalls the redbill (Haemotopus). Its common song seems to be near akin to that of the lark (Anthus); it tries to intimidate intruders that approach its nest with a low purring chur-r-r." "A few hours after sunrise they cease to sing or to answer each other's notes, and generally remain silent in fine weather during the day among the tree ferns and lower branches of the trees." (Smith.)

Nesting. "Not much secretiveness," writes Potts, "is displayed in the choice of a site for its nest; it may be found at varying distances from the earth, from four feet to twelve and upwards, usually at seven or eight. The structure is firmly and compactly built, with small sprays for the foundation, on which moss is abundantly interwoven with pliant twigs; the lining is usually of fine grass bents; some nests are finished off with soft tree-fern down; it is usually placed in tutu (Coriaria), sometimes in Coprosma or manuka. From the neighbourhood of its home, rivals of its own species as well as other birds are driven off."

References.—Sparrman, Mus. Carls. 2, No. 45, 1787 (*Tanagra capensis,* Dusky Sound). Quoy and Gaimard, Voy. Astrol. Zool., 1, 186, col. pl. 1830 (*Tanagra macularia,* Tasman Bay). Potts, Trans. N.Z. Inst., 5, 179, 1873. Buller, Birds N.Z., 139, col. pl. 1872; 2nd ed., 1, 31, col. pl. 1888. Fleming, Proc. Biol. Soc. Wash., 28, 121, 1915 (*Turnagra c. minor,* Stephen Id.). Oliver, Emu, 45, 147, 1945 (palate).

FAMILY CORVIDAE. CROWS

Bill strong, longer than head. Primaries ten, the first much shorter than the second. Tarsus posteriorly ridged, not scutellate. Nostrils covered with bristles.

GENUS CORVUS

First primary at least half as long as second, third and fourth longest, four outermost with inner webs sinuated. Tail rounded or slightly graduated. Nearly cosmopolitan but absent from South America, Lesser Antilles, Madagascar and parts of Polynesia.

Reference.—Linnaeus, Syst. Nat., ed. X, 105, 1758 (*Corvus,* type *C. corax* L.).

Australian Raven

Corvus coronoides

A solitary Raven, presumably the Australian species, visited Mokohinau on October 3rd and 4th, 1945, and on the following two days was seen on Little Barrier

Island. It was last seen flying towards the mainland. A raven was seen on Hen Island on January 3rd, 1949.

Adult. Entirely black glossed with purple; all the body feathers dusky grey at the base; throat feathers long and lanceolate. Bill and feet black. Iris white (brown when young). Bill 65, wing 368, tail 200, tarsus 60 mm. Australia.

Status. The Australian Raven is distinguished from the crow (*C. cecilae*) by the bases of the body feathers being dusky instead of pure white as in *cecilae*.

Distribution. Accidental. Mokohinau. Little Barrier Island. Hen Island.

South and eastern Australia. Tasmania. Accidental in Lord Howe Island.

Habits. The Australian Raven prefers the open country but returns to forested areas at dusk. It builds a rather large open nest of sticks, bark and grass in the fork of a tree high above the ground. The Raven is said to be very destructive during the lambing season because of its habit of picking out the tongues and eyes of lambs. It feeds on animals including insects and birds' eggs, and sometimes on fruit. It is, however, useful in clearing away carrion and keeping caterpillars and grasshoppers in check.

References.—Vigors and Horsfield, Trans. Linn. Soc., 15, 261, 1827 (*Corvus coronoides,* New South Wales). Buddle, N.Z. Bird Notes, 2, 70, 1947.

ORDER CORACIIFORMES

The birds included in this Order cannot be defined by external characters. The New Zealand members have the front toes parallel and more or less united. The young are born nearly naked.

Key to New Zealand Families

Bill short, broad, arched	*Coraciidae*
Bill long, narrow, straight	*Alcedinidae*

FAMILY CORACIIDAE
ROLLERS

Bill decurved at tip, cutting edge curved. Outer toe united to middle toe at base; inner toe united for its basal joint.

Genus Eurystomus

Bill short, depressed, slightly hooked, breadth at gape nearly equal to chord of culmen, nostrils linear, oblique; second and third quills longest. Tarsus less than half length of middle toe, scutellate.

Africa, India, and China, southwards to Australia. Nine species.

Reference.—Vieillot, Anal. nouv. Orn., 37, 1816 (*Eurystomus,* type *Coracias orientalis* L.).

Eastern Broad-billed Roller
Eurystomus orientalis pacificus

This Roller is commonly called in Australia the Dollar Bird on account of the bright silver spot on each wing. It is an occasional visitor to New Zealand, sometimes appearing in small flocks, and was first recorded in 1881, when specimens were taken in Westland (Mikonui River), Taranaki (Parihaka and Waiwakaio River) and North Auckland (Piha). Single individuals have since been observed, also a small flock in the Wairoa district in 1891.

Adult. Head and neck dark brown; upper surface of body and scapulars brownish green; wing coverts greenish blue; quills indigo blue, with a silvery blue patch on the primaries; tail bluish green at base, black at tip. Lores black; throat purplish blue, streaked with light blue; rest of under surface greenish blue. Bill orange-red, tip black, base yellowish. Iris dark brown. Feet reddish brown. Bill 28, wing 200, tail 100, tarsus 15, mid toe 30 mm. *Immature.* Differs from the adult in being dulled in colour and greenish on the throat instead of blue. Bill black.

Eggs. Clutch four, ovoid, white, 33.5 x 28, 32.8 x 25.4 mm. Northern Australia.

Status. Several subspecies have been defined of which the birds visiting New Zealand are presumed to belong to the East Australian Form (*E. o. pacificus*).

Distribution. Occasional visitor. Parengarenga, Great Barrier Island, Wairoa, Piha, Parihaka, Waiwakaio River, Stoke, Awatere, Hokitika, Mikonui River, Brunnerton. Akamotu.

Breeding in Australia. Winters in Celebes, Moluccas, New Guinea and Bismarck Archipelago. Occasional in Tasmania, Lord Howe Island and Norfolk Island. Arrives in Northern Australia in October, leaving again in March and early April.

Habits. Writing of the birds of Port Darwin district, Le Souef says, "These birds soon attract one's attention when in their neighbourhood, not only by their notes, but also by their curious antics when on the wing, and their habit, if disturbed when nesting, of darting into holes in trees, to mislead the intruder as to the hollow in which their eggs really are. They make no nest, the eggs being placed on the decayed wood at the bottom of the hollow."

In the breeding season it attacks furiously anyone who approaches the nesting hole. It is a noisy bird, uttering a peculiar chattering note and when on the wing ascends, dives and turns as if delight-ing in difficult aerial manoeuvres. It feeds mainly on beetles.

References.—Linne, Syst. Nat., 12th ed., 159, 1766 (*Coracias orientalis,* India). Buller, Birds N.Z., 2nd ed., 1, 118, 1888. Sharpe, Cat. Birds Br. Mus., 17, 33, col. pl. 1892.

FAMILY ALCEDINIDAE
KINGFISHERS

Bill long, with rounded culmen; gonys ascending towards the tip. Feet with flattened soles; outer and middle toes united for two joints; inner and middle united for basal joint.

Represented in New Zealand by a single indigenous species and by an introduced species.

Genus Halcyon

Bill compressed, gonys keeled. Second quill longest; secondaries nearly as long as primaries. Tail of 12 feathers, the outer ones shorter.

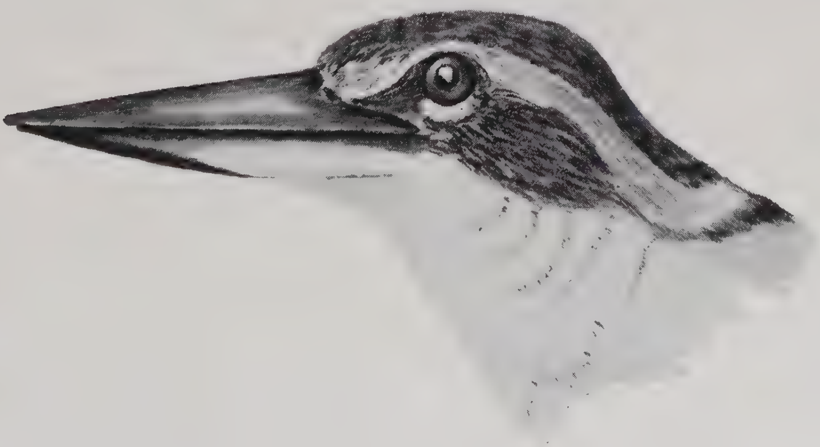
About fifty species distributed over Africa, Asia, from Asia Minor to Japan, southwards to Australia, Tasmania and New Zealand.

Reference.—Swainson, Zool. Illustr., 1, 27, 1821 (*Halcyon,* type *Alcedo senegalensis* L.).

New Zealand Sacred Kingfisher. Kotare
Halcyon sanctus vagans

The Sacred Kingfisher was first discovered at Dusky Sound in 1773 during Cook's second voyage, Forster, one of the naturalists who accompanied Cook, noting that its food consisted of fishes, snails, shellfish and crabs. Latham, in 1782, described it as the Sacred Kingfisher because of the veneration paid to it in some of the islands of the Pacific. For the same reason the specific name *sanctus* was bestowed by Vigors and Horsfield in 1827. Lesson, the naturalist on the *Coquille,* collected the species at the Bay of Islands in 1824 and named it *Alcedo vagans.* The American Exploring Expedition under Commodore Wilkes, in 1840, and the British Expedition under Sir James Ross, in 1841, also collected the Kingfisher at the Bay of Islands.

Adult. Top of head deep green, surrounded by a band of ultramarine; lores fulvous; from the lower half of the upper mandible a band of black, widest behind the eyes, surrounds the head; a broad buff collar; upper back and scapulars deep green; lower back, upper tail coverts and wings ultramarine, the quills brown except the outer edge which is washed with cobalt; central tail feathers ultramarine the edges washed with cobalt, other tail feathers ultramarine with outer edges washed with cobalt and inner edges brown. Throat and breast buffy white; rest of under surface deep buff. Bill black, base of mandible pale yellowish.



C. McCann

NEW ZEALAND SACRED KINGFISHER

Iris black. Feet dark brown. Bill 41-46, wing 100-105, tail 60-70, tarsus 15-16, mid toe 24-27 mm. *Immature* in first plumage: crown brownish green with buff edges to the feathers; front of forehead and line over loral space tinged with rufous; a blackish brown collar from gape under eye round back of neck; behind this a buff collar with brown edges to the feathers; back and scapulars brownish green; lower back, tail and wing coverts greenish blue, edged with buff; quills brown edged with buff. Throat white; rest of lower surface fulvous white, the breast feathers edged with brown. *Colour Varieties.* Pure white specimens of the Kingfisher have been taken and also individuals which are white with buff under surface and collar.

Eggs. Clutch five to seven, broadly elliptical, white, 29.5 x 24, 28 x 24.5 mm. Kaipara Harbour. 27.5 x 22.5, 29 x 23.5, 31.5 x 23 mm. Raoul Island.

Status. The Sacred Kingfisher varies somewhat in size and colour throughout its range. *H. s. vagans* is distinguished from the typical subspecies of Australia by its larger size and broader bill, and generally by the distinctness of its green and blue colours; deeper green on crown, upper back and scapulars; deeper blue on back, tail and wings; collar and under surface deeper buff.

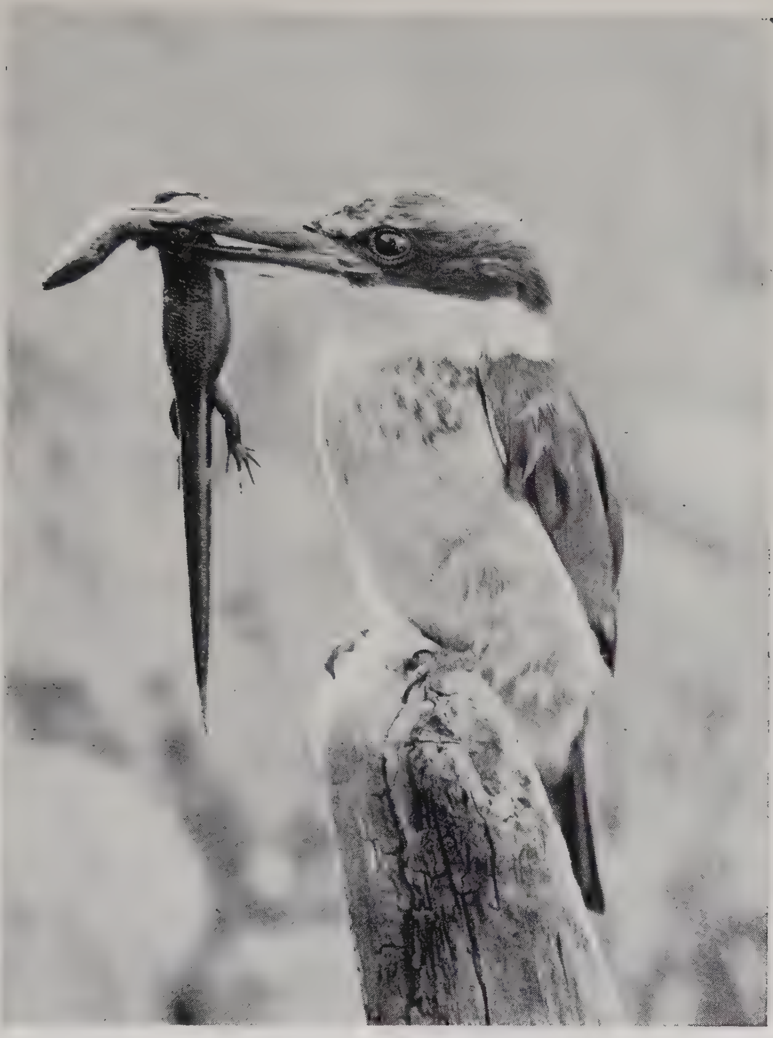
Distribution. Kermadec Group: Raoul and Meyer Islands. Three Kings, North and South Islands, Mokohinau, Poor Knights, Little Barrier, Great Barrier, Hen Island, Mayor Island, Karewa, Kapiti, Stewart Island.

Norfolk Island. Lord Howe Island.

The species *Halcyon sanctus* is found in the Moluccas, Lesser Sunda Islands, New Guinea, Australia, Tasmania, New Caledonia, and Solomon Islands.

Ecology. The Kingfisher is more a bird of the open than of the forest. It is usually to be found not far from streams or the sea coast and is widely dispersed throughout the more open country and edge of the forest, including the settled districts. Beaches, mud flats, intertidal rocks, mangrove swamps, lagoons, rivers and lakes are its favourite haunts. In winter it sometimes collects in small parties. I have seen more than twenty-five together on rocks exposed by the tide at Milford. The clearing of forest for European settlement has widened its habitat and farm operations such as ploughing have given access to insects, so probably the Kingfisher has increased its numbers during the past century. It frequents open spaces around and among the exotic pine forests at Whakarewarewa and Kaingaroa Plains. The Kingfisher is a fearless bird and readily attacks mammals and birds of its own size and larger. Starlings are driven away, red-billed gulls put to flight, a tui killed, cats and dogs blinded in one eye and, according to Stidolph, a weasel attacked. The enemies of Kingfishers are mostly the introductions of Europeans, stoats, starlings which occupy their building sites, and sportsmen who allege damage to young trout. The Kingfisher must be accounted a useful bird to the agriculturist. Occasionally, however, its omnivorous habits get it into trouble. It has been known, for instance, to feed on bees, to rear its young on cherries or peaches, to kill chickens and young ducks, to attack canaries through the wires of the cage, and even to take goldfish from a fountain.

Food. Every kind of small animal is attacked, killed and eaten by the Kingfisher. The introduced mouse is a first favourite and the bird's sharp eyes and quick actions are usually effective when one comes into view. Before being swallowed, the victim is pulped and its bones broken by battering on the Kingfisher's perch, the tail, however, must await the digestion of the body. Small birds such as silvereyes are eaten, their bodies first being battered to make them soft and to remove as many of the feathers as possible. Where lizards are plentiful the Kingfisher regales itself on these, sometimes, according to Guthrie-Smith, they form most of its diet. Lizards are killed by battering them against a stone or branch and then they are swallowed whole. Fish form only a small portion of the diet of the Kingfisher,



Little Barrier Island *K. V. Bigwood*

NEW ZEALAND SACRED KINGFISHER

but whitebait, grayling and bullies are taken from the lower reaches of rivers in spring. The Kingfisher occasionally catches fish from the surface of the water. It makes a slanting swoop and as it picks up the fish partly submerges. "Sometimes, however," says Stead, "Kingfishers really dive into the water, going in with bill, neck and body in a straight line, and wings clapped tight to the sides, after the manner of a Gannet."

The larger kinds of insects probably form the major portion of the diet of Kingfishers living inland. Crickets, grasshoppers, dragon flies and cicadas are all eaten. Fresh water crayfish are taken from rivers, while crabs form a large share of the food of coastal Kingfishers. In one locality Falla found that small crabs were the most important items in the Kingfisher's diet. After digestion the hard parts were disgorged in pellets of indigestible matter.

Voice. Although usually silent, in the breeding season the Kingfisher becomes very noisy. Then its harsh screech is heard as it darts about here and there, or its metallic "tap-tap-tap" announces its presence. If its nest be near, the intruder is soon informed by a sudden screech about his head as the Kingfisher swoops down at him.

Nesting. Sometimes a natural hole in a tree is used for a breeding place but more often the Kingfisher digs out a tunnel with its bill. A dead tree or a bank where the ground is not too hard is often chosen and both birds work industriously. Should they strike an obstruction, another burrow is attempted and yet others until success has been achieved. Kingfishers use considerable force when beginning to excavate their burrows. From a little distance, usually from a convenient perch, they dart at the tree or bank they have selected, hitting it with the point of their bills and so chipping off splinters of wood or some earth. When they strike hard wood they must get quite a shock. When the hole has been bored a few inches deep the birds enter it and continue excavating with their beaks. The burrow is a foot or more long, slanting slightly upwards and terminating in a spacious egg chamber about six inches across. In a nesting burrow examined at Tinopai the nesting chamber extended about six inches beyond the eggs. No nesting materials are brought into the burrow. Intruders deemed to be harmful are attacked, generally by swooping at them and suddenly screeching as the bird nears its mark.

The Kingfisher lays mostly during November and December. According to Potts, who closely watched a Kingfisher's nest during the laying period, six eggs were laid, firstly at intervals of two days and then of one day. The eggs took seventeen days to incubate and the young left the nest when twenty-four days old. Two broods are raised in a season. The female does most of the incubating, according to Wilkinson, while the male keeps her supplied with food. When the young are strong enough they come to the entrance of the nesting burrow to be fed. The same burrow may be used year after year. Stidolph records an instance in which a pair of Kingfishers occupied a nesting hole in a stump for seventeen years during which time the stump was shifted by a flood. The Kingfisher is a bad housekeeper, especially during the time the young are in the nest chamber. In a nest in a bank at Denham Bay, Raoul Island, there were, on February 16th, two fully fledged young and a dead one, which, with putrefying food and excrement, gave out an almost unbearable stench.

References.—Vigors and Horsfield, Trans. Linn. Soc., 15, 206, 1827 (*Halcyon sanctus,* N.S.W.). Lesson, Voy. Coquille Zool., 1, 694, 1830 (*Alcedo vagans,* Bay of Islands). Buller, Birds N.Z., 69, 1872; 2nd ed., 1, 121, col. pl. 1888. Potts, Trans. N.Z. Inst., 2, 52, 1870; 5, 172, 1873. Stead, Life Hist. N.Z. Birds, 123, 1932.

ORDER CUCULIFORMES

CUCKOOS

Bill slightly arched. Tail feathers 10 (except Crotophaginae). Toes two in front and two behind (the fourth toe either fixed backwards or capable of being turned either backwards or forwards). Young born helpless and not passing through a downy stage before acquiring feathers.

FAMILY CUCULIDAE
CUCKOOS

Bill slightly arched, sometimes hooked at the tip. Toes truly zygodactylous, that is, two permanently directed backwards and two forwards.

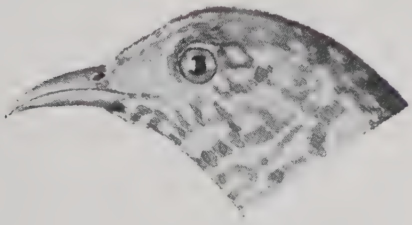
Key to New Zealand Genera

Bill moderate, equal to or shorter than tarsus.	
Bill slender, not decurved at tip.	
Plumage metallic	*Chalcites*
No metallic colours in plumage	*Cuculus*
Bill stout, decurved at tip	*Eudynamis*
Bill very large, more than twice length of tarsus	*Scythrops*

GENUS CHALCITES

Bill deeper than wide (wider than deep in New Zealand species), slightly arched, culmen ridged. First quill very short, third longest. Tail rounded. Tarsus with broad scales.

The Shining Cuckoos are small birds recognised by their barred under surface and metallic green upper surface. There are about eight species comprising 22 subspecies found in India, south-east Asia, Malay Archipelago, Melanesia, Australia and New Zealand.



E. H. Atkinson

SHINING CUCKOO

Reference.—Lesson, Traite Orn., 2, 152, 1830 (*Chalcites,* type *Cuculus basalis* Horsfield). Cabanis and Heine, Mus. Hein., 4, 11, 1864 (*Lamprococcyx,* type *Cuculus lucidus* Gmel.).

Shining Cuckoo. Pipiwarauroa

Chalcites lucidus lucidus

The Shining Cuckoo was discovered at Queen Charlotte Sound by Forster during Cook's second voyage, but the only remark recorded about it was that it inhabited the forest. Latham, who described Forster's specimen, called it the Shining Cuckoo, a title adopted by Gmelin when founding the specific name. The migratory and parasitic habits of the Shining Cuckoo were early noticed though many incorrect statements were made regarding them. Lesson, who visited New Zealand in 1824, includes the Shining Cuckoo in his account of the birds observed by the expedition. Yate in 1835 stated that the piriwarauroa was a bird of passage; but the natives assured him that it retired in winter into holes in trees or crevices in rocks. Dieffenbach, in 1840, was the first to give any accurate information, stating that it lays its eggs in the nests of smaller birds, especially that of the fan-tailed flycatcher. Colenso in 1841 came across this cuckoo at Anaura, south of Tokomaru Bay and described it as abundant.

Adult Male. Upper surface golden metallic green, coppery in certain lights, outer tail coverts white on outer margins, frontal feathers tipped with white; quills dark brown with coppery reflections, changing to golden green on the secondaries; tail bronzy green with a subterminal band of dark brown; outer tail feathers (fifth) broadly barred with white on the inner webs and spotted with white on the basal portion of the outer webs; fourth with two rufous and a terminal white spot on the inner web; third similar to the fourth but without the rufous markings. Sides of face and under surface white, barred with golden green. Bill black. Iris reddish brown. Feet slaty black, soles yellowish. Bill 11-12, wing 98-107, tail 67-70, tarsus 12, longer fore toe 20 mm. *Adult Female.* Similar to male but crown and hind neck more purplish bronze, bars on under surface more bronzy, rufous spots on fourth tail feathers usually larger. *Immature.* Upper surface bronzy green, more bronzy on head and neck; lower surface white mottled and barred with brown, becoming bronzy green on the sides. There are intermediate phases in the changes to the adult. *Colour Variety.* There is an albino in the Wanganui Museum.

Eggs. Clutch number unknown, elliptical, from greenish or bluish white to olive brown or dark greenish brown. 18 x 12.5 mm. Wanganui. 19 x 13 mm. Rockwood, Canterbury. 19.5 x 12.4 mm. Clevedon.

Status. As subspecies of *C. lucidus* Mayr includes *lucidus* of New Zealand, *plagosus* of Australia, *layardi* of New Caledonia and *harterti* of Rennell and Bellona Islands, Solomon group. The distinctive characters of the subspecies *lucidus* as given by Mayr are the broad bill, white on forehead and sides of face, greenish reflections in purple bronze of crown and hindneck, bars on under surface more greenish, narrow bars on throat, pure white spots and bars on outermost tail feathers, and rufous spots on fourth tail feathers.

Distribution. North, South and Stewart Islands. Kermadec Islands. Mokohinau, Great and Little Barrier Islands, Hen and Chickens, Poor Knights, Mayor Island, Kapiti, Chatham Islands. Common everywhere in the summer months, occasional in winter.

Winters in the Solomon Islands, also on Nissan and Feni to the north and possibly in the Bismark Archipelago. Occasional on Lord Howe and Norfolk Islands during the migration seasons to and from New Zealand. Hindwood records that Roy Bell collected eighteen specimens in Lord Howe Island in February, 1915, during and after a heavy storm. Eggs have been taken on both Lord Howe and Norfolk Islands.

Ecology. The Shining Cuckoo may be regarded as mainly a bird of the forest though it spreads widely over the scrub lands and cultivated districts, in fact, wherever there are trees or shrubs. It is found in the exotic pine forests on the Kaingaroa Plains and Stidolph reports it as preferring the willows in the Wairarapa district. It is said to be scarce where Grey Warblers are scarce but in the Wairarapa warblers are frequent in both the willows and the manuka but according to Stidolph the cuckoo does not follow them into extensive blocks of manuka country.

The Shining Cuckoo is known to breed only in New Zealand. It begins to arrive about the middle of August, arrivals increase in numbers during September and gradually the whole country is occupied, the southern end of the South Island and Stewart Island being reached during October. Occasionally in the south birds arrive quite early, for example, a cuckoo was reported in the Catlins district on September 14th. These general results were recently demonstrated by H. B. Fell in an investigation carried out in 1945, except that the first report for Stewart Island in 1945 was November 8th, his information being obtained from over 200 informants alerted by notices in *Forest and Bird,* the journal of the Forest and Bird Protection Society of New Zealand. The return journey to the Solomon Islands is made by the Shining Cuckoo during January, February and March. Very few birds are encountered in New Zealand in April and only occasionally does one remain through the winter and then so far as is known a young bird which probably was hatched late in the summer.

The main winter quarters of the Shining Cuckoo, namely, the Solomon Islands, are

Masterton *J. M. Cunningham*
SHINING CUCKOO, IMMATURE

about 2,000 miles from New Zealand. Between is an almost unbroken expanse of ocean and only on Lord Howe and Norfolk Islands have a few Shining Cuckoos of this subspecies, evidently stragglers, been noticed. From eastern Australia there are only a few doubtful records of this subspecies having been taken. And so the story of how and by what route the New Zealand Shining Cuckoo travels between its winter and summer quarters is yet to be told. Little is known about the size of the migrating flocks, but about 200 birds were seen together at Maunganui Bluff on October 1st, and single birds have been seen coming in from the sea. Potts once found a Shining Cuckoo in an exhausted state on Chatham Island to which a few cuckoos make their way from New Zealand or, possibly, they miss New Zealand and accidentally make a landfall on the Chathams.

The effects of the parasitic habits of the Shining Cuckoo on the Grey Warbler must be considerable as the cuckoos are plentiful everywhere in New Zealand. The first brood of the Grey Warbler, unless delayed, escapes the attention of the cuckoo but later broods suffer heavy casualties in their nestling stage as the young cuckoo invariably throws out all eggs and young from the nest it occupies.

There is no evidence to show whether or not the clearing of forests in New Zealand has resulted in a decrease in numbers of cuckoos visiting the country though probably this has taken place to some extent especially as Grey Warblers like all bush birds have suffered through the change from forest to grassland, though they are well distributed in settled districts. There must be a considerable wastage of cuckoos on migration.

Food. The food of the Shining Cuckoo consists almost entirely of insects and their larvae including the hairy caterpillar of the magpie moth (*Deilmera annulata*) which is avoided by all other birds. The cuckoo seems to be especially partial to these caterpillars which feed on the leaves of an introduced creeper locally called Cape ivy (*Senecio mikanioides*). The presumably irritating hairy skins are rejected by the cuckoo. Other favoured caterpillars are those which feed on the kowhai, on ragwort, and on cruciferous plants (white butterfly). Scale insects and plum and pear slugs are eaten by the Shining Cuckoo which thus carries out a very useful service to orchardists. The cuckoo robs the nests of small birds of their eggs, the Grey Warbler and Chaffinch being recorded as its victims.

Voice. The characteristic cry of the Shining Cuckoo, that by which it can be recognised from all other birds in New Zealand, consists in a series of double notes, upward slurs, several times repeated, followed by fewer downward slurs, the whole in a musical whistle with ventriloquistic effects. The first notes always sound a considerable distance away and the rest appear gradually to approach the listener until the bird may be discovered within a few feet of him. There is another note uttered when the cuckoo is flying at night and aptly described by Stidolph as a sighing note. The young cuckoo's note is weak and plaintive. After the middle of February cuckoos are not heard though they may not have left the country.

Nesting. There is some evidence to show that the Shining Cuckoo is polyandrous. Fulton states that females are always in a considerable minority and "the bronze cuckoo, like parasitic cuckoos and cowbirds elsewhere, is polyandrous." Confirmation of this comes from L. W. McCaskill who, in a letter to me, states that he saw three cocks associating with a hen in a manner that verified their polyandrous nature.

Like most members of the order, the Shining Cuckoo is parasitic, its principal hosts being the Grey Warbler and the Chatham Island Warbler, but eggs have been reported in the nests of fantails, tomtits and silvereyes. Eggs of the Shining Cuckoo have also been reported in the nests of some introduced species of birds including the sparrow and the chaffinch. Probably the cuckoo uses nests other than warblers only when warblers' nests are scarce.

There is some doubt about the method of placing the cuckoo's eggs in the warblers' nests. The following appears to me to be the most acceptable account, quoting from Andersen: "T. W. Downes told me he had seen the act performed. The pipiwharauroa clings to the nest, forces itself through the narrow opening, breaks a way through the opposite wall, sits on the nest with is head and neck protruding from one side and its tail from the other, lays its egg and leaves the apparently ruined nest. On the return of the riroriro, that bird repairs the damage instead of deserting the nest with the intruding egg."

The Shining Cuckoo lays in November and December. The egg takes about twelve days to incubate and the young cuckoo a similar period to acquire its first plumage. Meantime it has grown with incredible speed, taxed the resources of both foster parents to their utmost to keep it supplied with food and either trampled on or thrown out the rightful occupants of the nest, none of which has any chance of obtaining any food after the cuckoo has been hatched. It seems a remarkable perversion of the instincts of the foster parents that they should work so hard for an impudent murderer and apparently have no regrets for the fate of their own offspring.

Both the Grey Warbler foster parents feed the cuckoo in their nest and continue to do so after the cuckoo has left the nest. In fact they may feed young cuckoos other than the one they have reared. The caretaker of Little Barrier Island, C. Parkin, has recorded three shining cuckoos being fed by one grey warbler. Other birds also assist apparently being moved to do so by the plaintive cries of the young cuckoo. The cuckoo's own parents, presumably, also take part in rearing their progeny for they have been seen feeding one or more young cuckoos and teaching them to sing. Young cuckoos, after they leave the nests sometimes associate in twos and threes.

References.—Gmelin, Syst. Nat., 421, 1788 (*Cuculus lucidus*, Queen Charlotte Sound). Buller, Birds N.Z., 77, 1872; 2nd ed., 1, 132, col. pl. 1888. Fulton, Trans. N.Z. Inst., 42, 392, 1910. Andersen, Bird Song, 164. 1926. Mayr, Amer. Mus. Nov., no. 520, 1932. Fell, Trans. Roy. Soc. N.Z., 76, 504, 1947. Cunningham, Notornis, 5, 192, 1953.

GENUS CUCULUS

Bill not so wide as deep, slender. Wing reaching beyond tail coverts. Tail fan-shaped. No metallic colours in plumage. Twelve species comprising about 33 subspecies world wide in distribution except Polynesia.

Two Australian species have occurred in New Zealand accidentally.

Key to Species

Tail slaty black with white spots. Under surface barred with black	*C. saturatus*
Tail grey notched or barred with white. Under surface nearly uniform	*C. pallidus*

Reference.—Linne, Syst. Nat., 110, 1758 (*Cuculus*, type *C. canorus*, L.).

Oriental Cuckoo

Cuculus saturatus horsfieldi

This widely dispersed species has only thrice been noticed in New Zealand. In February, 1902, a specimen was shot at Lake Te Anau, and in December, 1944, a young bird was sen at Motupipi, near Takaka. It was later found dead and forwarded to the Dominion Museum.

Adult. Head and upper surface blue-grey; quills dark brown, the outer primaries notched with white on their inner webs; tail feathers slaty black with white spots and tips. Throat pale grey, remainder of under surface white shaded with buff on breast and under tail coverts, lower breast and abdomen regularly barred with black. Bill blackish above, greenish below. Iris stone colour, eyelid bright yellow. Feet dull yellow. Bill 23, wing 188, tail 160, tarsus 18, longer fore toe 27 mm. *Immature.* General colour blackish brown, with white margins to the feathers; a few rufous partial bars on wings and tail; chest and abdomen with broad white bars. *Rufous Phase.* Upper surface cinnamon, barred with black; tail distinctly barred with black and marked with white, and with broad subterminal black band; under surface buffy white barred with black on throat and abdomen.

Distribution. Three occurrences. Te Kao, Takaka, Lake Te Anau.

Siberia and Japan southwards through India and China to the Malay Archipelago, New Guinea, Solomon Islands and Australia. Visitor to Lord Howe Island.

Habits. Very little is known about the habits of the Oriental Cuckoo. Generally it is found near the coast, and is said to be a shy and solitary species. It breeds in eastern Asia and is parasitic.

References.—Blyth, Jour. As. Soc. Beng., 12, 942, 1843 (*C. saturatus,* Nepal). Horsfield and Moore, Birds East India Corp., 2, 703, 1857 (*C. horsfieldi,* Java). Mathews, Birds Austr., 7, 287, col. pl. 1918.

Pallid Cuckoo

Cuculus pallidus

There is only one record of the Pallid Cuckoo being taken in New Zealand. A bird that had visited Craig Flat on the Molyneux River, near Beaumont, for three consecutive years, was found dead on September 17th, 1941, and was sent by Mrs. Adams to the Otago Museum. The same species was seen by R. A. Falla at Okarito in December, 1941, and by E. L. Kehoe at Greymouth, in March, 1942.

Adult. Upper surface greyish brown; front edges of wing white; wing coverts margined and notched with whitish; quills dark brown, barred on their inner webs with white; upper tail coverts with more or less white on the margins; tail bronze brown, the feathers notched with white and shaded with dark brown on both webs. Under surface ash grey, with tinge of buff on throat and breast; lower flanks, thighs and under tail coverts faintly barred white and grey. Bill blackish horn. Iris brown, eyelid yellow. Feet greenish grey. Bill 22, wing 191, tail 162, tarsus 19, longer fore toe 24.5 mm. Craig Flat. (Mmts. by Marples.) *Female.* Spotted and marked with chestnut and buff on head, back and upper wing coverts, tail feathers with chestnut and white notches. *Immature.* Upper surface brown, the feathers broadly margined with white or smoky white, more broadly on head, scapulars and wing coverts; lower back white with brown shaft streaks; quills dark brown notched with white or buff; tail feathers sooty brown deeply notched with whitish. Lower surface white, the throat darker, like the head. Bill yellowish horn. Iris brown. Feet horn coloured.

Eggs. Oval, glossy, flesh pink, sometimes faintly spotted with reddish. 24 x 17, 24.5 x 17 mm.

Distribution. Craig Flat, Clutha River. Okarito and Greymouth, sight records.

Australia, Tasmania, Moluccas, New Guinea.

Habits. When recording the presence of the Pallid Cuckoo in New Zealand Marples stated that Mrs. Adams of Craig Flat informed him that the bird had been seen in that district for three years, appearing before May and departing in October. In spring it whistled and would allow a close approach if replied to. It frequently accompanied the settler by flying from post to post as he walked along the road. In its stomach were found twenty-eight black hairy caterpillars and four others and a few earthworm chaetae.

In Tasmania the Pallid Cuckoo is present from September to March or April, while in Western Australia, according to Serventy and Whittell, it arrives in May or June and is heard until November or December. Apparently therefore this cuckoo is a summer visitor to Tasmania and spends most of the year, including the winter, in Australia. Its appearance in New Zealand corresponded with its winter sojourn in Australia.

The Pallid Cuckoo, like most other cuckoos, is parasitic and lays its eggs in the open nests of quite a number of species of Australian birds. Littler gives a list of fourteen species of Tasmanian birds known to be foster parents, half of them honeyeaters.

Reference.—Latham, Ind. Orn. Suppl., 60, 1801 (*Columba pallida,* New South Wales). Marples, Bull. Orn. Soc. N.Z., no. 2, 1942.

GENUS EUDYNAMIS

Bill stout, strongly arched, the tip pointed, decurved and overlapping the lower mandible. Fourth quill longest. Tail long and wedge-shaped, outer feathers much shorter than central ones.

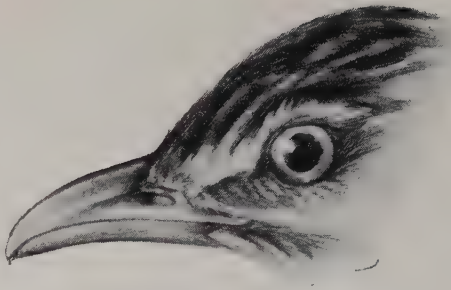
Two species: New Guinea, Western and Central Pacific, Australia, Tasmania, New Zealand.

References.—Vigors and Horsfield, Trans. Linn. Soc., 15, 303, 1827 (*Eudynamis,* type *Cuculus scolopaceus* L.). Salvadori, Orn. Papua, 1, 370, 1879 (*Urodynamis,* type *Cuculus taitensis* Sparrms.).

Long-tailed Cuckoo. Koekoea

Eudynamis taitensis

The Long-tailed Cuckoo was seen in the East Cape district in October, 1769, during Cook's first voyage. During the second voyage it was collected in the Society group, hence the specific name bestowed by Sparrman. Yate, in 1835, correctly describes a specimen from New Zealand and gives what is evidently a native version of its disappearance in winter, namely, that it hides among stones or in holes of the puriri tree. The first New Zealand specimens to be received in England were collected by Miss R. Stone and P. Earl about 1840. Earl observed that it arrived in the neighbourhood of Cook Strait from the north in October and returned in April. The egg of the Long-tailed Cuckoo was first described by Fulton in 1904.



Lily A. Daff

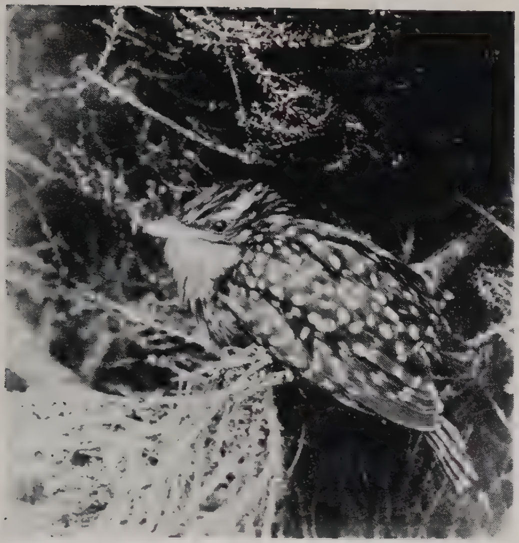
LONG-TAILED CUCKOO

Adult Male. Crown and nape blackish brown streaked with rufous; back, scapulars and wing coverts blackish brown with rufous bars and pale rufous or, on the wing coverts, white tips; quills dark brown barred with light rufous; tail feathers barred blackish brown and rufous and tipped with whitish. Lores and superciliary streak white. Under surface white to buff striped with dark brown; under tail coverts whitish barred with dark brown. Bill dark brown above, pale horn below. Iris dull yellow. Feet olive green, soles yellowish. Bill 23-25, wing 188-195, tail 230-250, tarsus 32-38, longer fore toe 32-35 mm. *Adult Female* similar but slightly smaller, the rufous markings on the upper surface darker and the under surface more rufous. *Immature* similar to female, but spots on upper surface white and the bars on the tail whitish or buff. *Colour Varieties.* White specimens with or without brown on a few feathers have been taken. Feet yellow.

Eggs. Ovoid, tapering a little both ends but one end more pointed, creamy white spotted and blotched all over with purplish brown and grey, most dense at the larger end. 23.5 x 17 mm. Silverstream. 22 x 16.6, 22.8 x 17.5, 23.5 x 17 mm. Jacky Lee Island.

Distribution. Kermadec Islands, Three Kings, North and South Islands, Little and Great Barrier Islands, Kapiti, Stewart Island, Chatham Islands. Straggler to Auckland Islands.

Winters chiefly in Fiji, Tonga, Samoa,



Kapiti Island *A. S. Wilkinson*
LONG-TAILED CUCKOO, IMMATURE

Cook, Society and Tuamotu groups, but also observed in Lord Howe and Norfolk Islands, New Caledonia, northward to the Solomon Islands, Bismarck Archipelago, Caroline and Marshall Islands and eastward to the Marquesas and Austral Islands.

Ecology. The Long-tailed Cuckoo is a bird of the forest where often it is seen or more often heard in the tree tops. It also frequents the scrublands and cultivated districts where it takes refuge from numerous persecuting smaller birds in the dense foliage of imported trees. It has invaded the exotic tree plantations in the Whakarewarewa and Kaingaroa Plains districts.

The Long-tailed Cuckoo arrives in New Zealand early in October and leaves again in February and March. Sometimes a few are seen or heard in advance of the arrival of the main body, and stragglers lag behind or perhaps remain in New Zealand throughout the year as they have been taken in June. In the Kermadec Group a few individuals are present throughout the year. They are most commonly seen in March and October.

The number of Long-tailed Cuckoos that visit New Zealand is probably less than formerly owing to the reduction of the birds by the clearing of the forest in New Zealand. Further, the Cuckoo's favourite dupes, the Whitehead and Brown Creeper, have diminished apace with the Cuckoo. The result is that the Cuckoo is sometimes forced to lay its eggs in other kinds of birds' nests, birds which do not take kindly to the attentions of the Cuckoo. Parasites must necessarily share the hazards of their hosts. New Zealand is the only country in which the Long-tailed Cuckoo is known to breed and so the fate of the species depends on its finding suitable kinds of birds to rear its young. Reports on the decrease of the Long-tailed Cuckoo have been received from Nelson, Banks Peninsula and Southland. With the reduction of the Cuckoos there will be a reduction in the number of birds killed by the Cuckoos eating young and eggs from nests and by the young Cuckoos ejecting the nestlings of their foster parents.

Food. Insects probably constitute the principal food of this species. It also eats lizards, young birds and eggs, and occasionally it kills adult birds as large as bellbirds, sparrows and thrushes. On account of its predatory habits its presence creates a great commotion among the smaller kinds. It is immediately attacked by the tui and quickly put to flight.

Voice. The call of the Long-tailed Cuckoo is easily distinguished from that of other birds. It is a loud shrill whistle or screech and is to be heard at all hours of the night as well as during the day. It is fully described and put to musical notation by Andersen.

Nesting. The Long-tailed Cuckoo parasitizes several kinds of birds in New Zealand of both native and introduced species. It lays its eggs during November and December. The favourite dupes are the Whitehead in the North Island and the Brown Creeper in the South Island, but other species in whose nests the eggs of the Cuckoos have been found are the Yellowhead, South Island Tomtit, South Island Robin, Silvereye and the introduced Greenfinch and Thrush. Reports that the Long-tailed

Kapiti Island *A. S. Wilkinson*

WHITEHEAD FEEDING YOUNG LONG-TAILED CUCKOO

Cuckoo lays its eggs in the nests of Grey Warblers are no doubt due to confusion with the Shining Cuckoo, while the contention that the Grey Warbler had been seen feeding a Long-tailed Cuckoo on the ground is no proof that the Warbler incubated the Cuckoo's egg. Reports regarding the feeding of young cuckoos by pigeons and tuis are on record but it is improbable that they are correct.

The question as to how the Long-tailed Cuckoo transfers its egg to the nest of the bird that incubates it is still uncertain. Some assert that the Cuckoo lays is egg on the ground and carries it to the nest in its bill, others say that the Cuckoo lays its eggs directly in the nest of the dupe. The latter method is probably the correct one.

Stidolph observed both the male and female foster parents, in this case Whiteheads, feeding the young Cuckoo in the nest.

References.—Sparrman, Mus. Carls., 2, 32, 1787 (*Cuculus taitensis,* Tahiti). Buller, Birds N.Z., 73, col. pl. 1872; 2nd ed., 1, 127, col. pl. 1888. Fulton, Trans. N.Z. Inst., 36, 113, 1904. Andersen, Bird Song, 179, 1926. Stead, Trans. Roy. Soc. N.Z., 66, 182, 1936. Bogert, Am. Mus. Nov., no. 933, 1937. Wilkinson, Amy, N.Z. Bird Notes, 2, 77, 1947. Cunningham, N.Z. Bird Notes, 3, 176, 1949. Wilkinson, Kapiti Bird Sanct., 49, 1952.

Genus Scythrops

Bill large and robust, more than twice the length of the tarsus, and with lateral grooves on each side. A single species.

Reference.—Latham, Ind. Orn., 1, 141, 1790 (*Scythrops,* type *S. novaehollandiae*).

Channel-bill

Scythrops novaehollandiae

Only one specimen of the Channel-bill has been taken in New Zealand. It was presented to the Otago Museum by Mrs. Thompson of Invercargill in December, 1924.

Adult. Head and neck pale grey; rest of upper surface dark olive grey, the feathers of back and wings with broad brownish black ends, wing coverts with buff edges; quills dark brown edged with buff; tail pale olive grey, the feathers with alternate bands of white and black on the inner webs, the terminal white and the subterminal black bands on both webs. Under surface greyish white with brown crossbars on sides of body, thighs and under tail coverts. Bill yellowish brown. Iris red, orbits and lores scarlet. Feet olive brown. Bill 100, wing 355, tail 280, tarsus 42 mm.

Eggs. Oval, slightly glossy, vinaceous buff, blotched with chestnut and purplish brown. 42 x 29, 41 x 32 mm.

Distribution. Invercargill.

Malay Archipelago, New Guinea, Australia, Tasmania. Straggler to New Caledonia.

Habits. The Channel-bill feeds on insects and fruit and, it is reported, the capsules of gum (*Eucalyptus*) trees. It lays its eggs in the nests of currawongs, magpies, crows and sparrowhawks. Its note is a loud scream. It is a migrant between south-east Australia, where it is present from September to March, and north Australia and the Malay Archipelago.

References.—Latham, Ind. Orn., 1, 141, 1790 (*Scythrops novaehollandiae*, New South Wales). Marples, Bull. Orn. Soc. N.Z., no. 2, 1942.

ORDER PSITTACIFORMES

PARROTS

Bill strongly hooked, furnished with a cere; upper mandible moveable. Toes two in front and two behind; tarsi reticulate. Young hatched naked but passing through a downy stage before acquiring feathers.

Key to New Zealand Families

Bill longer than deep; lower mandible nearly straight .... *Nestoridae*
Bill deeper than long; lower mandible curved upwards
  Lower mandible smooth .... *Psittacidae*
  Lower mandible ridged .... *Strigopidae*

FAMILY NESTORIDAE
NEW ZEALAND PARROTS

Bill longer than deep, much compressed, lower mandible slightly curved. A single genus.

GENUS NESTOR

In addition to the family characters may be added: Cere partly covered with hairy feathers; tongue with a hair-like fringe at the tip; tail feathers with shafts projecting.

Besides the two New Zealand species there was a third on Norfolk Island (*N. productus*), characterised by the breast being yellow.

Key to Species

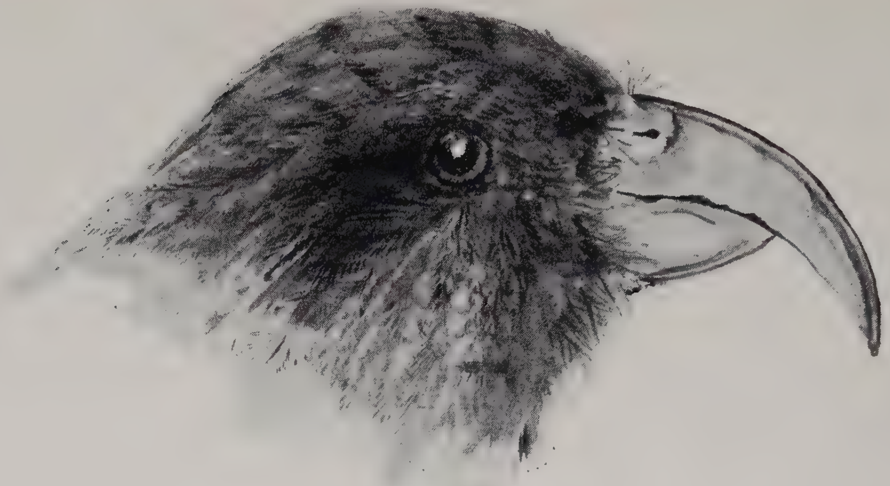
Under surface of body without crimson; upper mandible not channelled .... *N. notabilis*
Under surface of body with crimson; upper mandible channelled
  Crown greyish brown, wings and back olive brown .... *N. m. occidentalis*
  Crown greenish white, wings and back greenish brown .... *N. m. meridionalis*

Reference.—Lesson, Tr. Orn., 190, 1830 (*Nestor,* type *Psittacus meridionalis* Gmel.).

Kea
Nestor notabilis

The Kea was first obtained by Mr. W. B. D. Mantell in 1856 in the Murihiku district which includes the western portion of Otago. Within the next ten years it was found in various other mountain localities as far north as Arthur Pass, and later was discovered at the headwaters of the Hurunui. In 1904 it was taken at Riwaka and Appleby in the north of the Nelson Province. In 1942 a bird was reported as having been seen in the Tararua Range, but the species is not established in that area.

Adult Male. Upper mandible long, less curved than in *N. meridionalis,* not channelled. Top of head and hind neck yellowish green, obscurely striped with black; back and wings olive-green, each feather broadly edged with black; rump and upper tail coverts red with olive centres and black tips; tail bluish green with a black band near the tip; quills blue on their outer webs, remainder blackish brown. Facial disc olive-brown; under surface pale olive-green, the feathers tipped with dark brown; under wing coverts and axillaries scarlet, mostly tipped with dark brown; inner webs of quills and tail feathers blotched with lemon-yellow. Bill greyish brown. Iris brown or black. Eyelid and cere yellow. Feet olive. Bill 50-58, wing 330-335, tail 160-190, tarsus 40-45, longer fore toe 57-63 mm. *Adult Female.* Upper mandible shorter than in male and less curved. Plumage similar to male but slightly duller. Bill 42 mm. *Immature.* Similar to adult but lower mandible gamboge yellow with black tip. Eyelids lemon



Nora Stidolph

MALE KEA

yellow. Cere gamboge yellow. A broad yellowish green band from upper mandible through eye to nape, widening behind. Feet dark grey with black claws. *Nestling.* Covered with long light grey down. Bill and bare skin on face yellow. *Colour Varieties.* In the Canterbury Museum is a canary-yellow specimen, with the inner primaries and various feathers scattered over the head, breast and ~~wings normal.~~ The feathers normally red are yellowish red. Buller records from Otago two other canary-yellow specimens with red feathers as in the normal plumage.

Eggs. Clutch four, ovoid, granulated or nearly smooth, white, 47.5 x 33.5 mm. Rangitata Gorge. 43.5 x 32.5 mm. Mount Cook. 42 x 32.5 m. Rakaia Gorge.

Status. In the shape of the bill which is, so far as I am aware, the least curved among the parrot order, the Kea differs conspicuously from the Kaka. The Kea's bill is narrow from culmen to cutting edge, has no groove, and is arched, while that of the Kaka is deeper, grooved, and curved to such an extent that the tip is vertical to the gape. In its less curved bill the Kea shows a structure more primitive than in the Kaka or of the Kaka's relative *Nestor productus* of Norfolk Island, which has a very long bill.

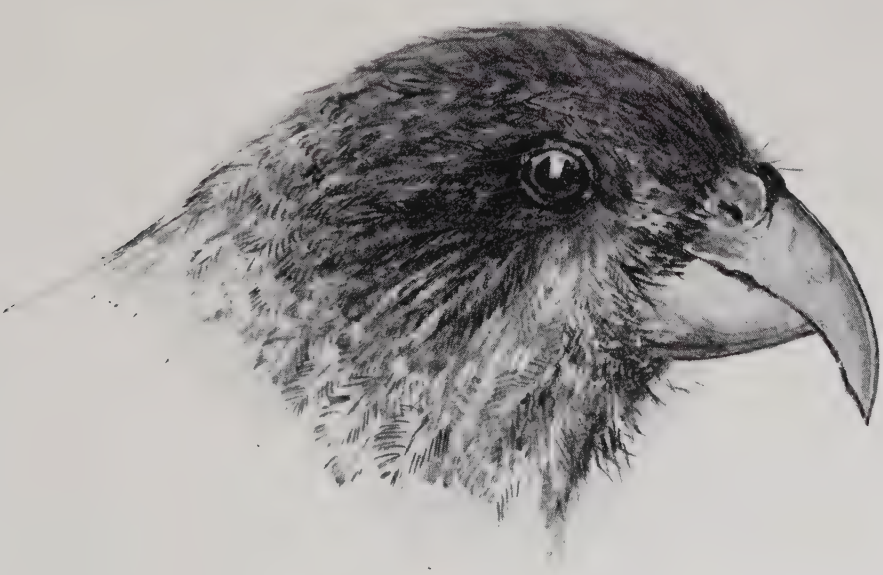
Distribution. South Island. Up to about 1870 the Kea was not known north of the headwaters of the Hurunui River, but subsequently it has increased in numbers and simultaneously extended its area of distribution, it now being found in Nelson and Marlborough and further eastward in Otago. In pre-European times in the North Island and on the Chatham Islands.

Ecology. Above the forest line all along the Southern Alps, are extensive areas partly covered with scrub and tussock, partly bare rocks and shingle, and mostly precipitous and difficult to traverse. This and the upper margin of the forest is the home of the Kea. In the eastern portion of this mountainous region the forest, mostly beech (*Nothofagus*), is far less extensive and consequently there is more of the rugged, exposed country. All this region is exposed to a mountainous climate, snow and bleak winds in winter, mist and wind in summer. Here, however, among the crevices of almost inaccessible rocks, or crossing from mountain to mountain high overhead, the Kea is to be found

Since the investigations into the sheep killing propensities of the Kea were made by G. R. Marriner in 1907, and which were the basis of his very informative book *The Kea,* practically no work has been systematically carried out to elucidate the life history of this remarkable species. Instead there have been published in magazines and newspapers many accounts from station owners and shepherds. There is general agreement among these eye-witnesses but the stories should perhaps be discounted to allow for exaggeration and the tendency to include among the damage attributed to the Kea all sheep found dead whether from natural causes or the attacks of Keas. Keeping this in view the facts as known may be summarised as follows.

From being a harmless or perhaps useful vegetarian and insectivorous bird the Kea has become a meat eater and on occasions a sheep killer. It is not to be understood by this that the species is now as a whole carnivorous. Far from it: but some Keas have taken to eating meat from dead sheep and to attacking helpless sheep, and others, evidently fewer, have taken to worrying and causing the death of healthy sheep. About 1867 there were observed on certain sheep runs in the vicinity of Lake Wanaka, Otago, flesh wounds both open and healed on the loins of many of the sheep. In some cases even the entrails were seen hanging out of a hole in the sides of the abdomen. Investigations were instigated on Mr. Henry Campbell's station, and in 1868 Mr. James MacDonald, the head shepherd, reported that he found a mob of sheep snowed in and being attacked by Keas. A bird would settle on the sheep's loin and peck into the sheep which would run through the mob, but the Kea would hold on until it got a piece of flesh when it would fly to the rocks. Since then, many similar incidents have been recorded so that there can be no reasonable doubt that certain Keas have developed a habit of attacking sheep.

Not all Keas are sheep killers. According to R. L. Wigley there is usually only one killer in a party but all will eat and clean up the carcase. Keas will tear off pieces of flesh while the sheep is still alive. They will attack any part of the sheep but naturally they can gain an entrance most easily between the ribs and the pelvis and this has given rise to the theory that they



Nora Stidolph

FEMALE KEA

Caswell Sound *K. V. Bigwood*

MALE KEA

prefer the fat round the kidneys. Keas usually attack at dusk or dawn. Flocks will assail sheep which thereby become panic stricken and dash themselves to death or injury over cliffs.

Various estimates have been published of the destruction of sheep wrought by Keas. In some cases very high figures have been given, apparently, however, without allowing for the natural loss in mountainous country, which might be as much as five per cent. During eight years 29,000 Keas were killed, this figure being obtained from the royalties which were paid for their beaks. A station near Mount Cook reported 500 sheep a year being killed over a period of thirteen years out of a flock of between five and six thousand. Keas will also kill goats and eat the flesh of deer from animals killed by deer shooters.

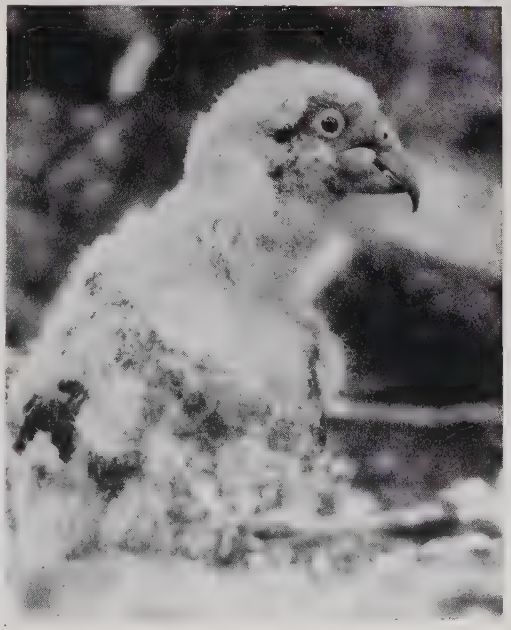
Most important is it to inquire into the origin of the sheep-killing habit of the Kea as therein probably lies the remedy. The balance of evidence is in favour of the habit beginning by the birds acquiring a liking for flesh and fat by finding it where offal and sheep skins are lying about. The further development of this meat-eating habit to dead animals and then to live ones is not hard to understand. In support of this explanation it has recently been stated that where meat and fat are not left about, the sheep are not molested by Keas, and even the habit of attacking sheep has stopped when meat ceased to be left exposed. This is what might have been expected of a new habit so suddenly acquired. It seems obvious, therefore, that the sheep-killing Keas are victims of their environment, from which it follows that the habit would not be infective or hereditary and the remedy would be not to leave meat and fat or, if possible, dead sheep where Keas can get them and so acquire the habit of eating flesh. Certain it is that indiscriminate shooting is no remedy but brings suffering to innocent and guilty birds alike. That the Kea will ever be exterminated by shooting is far from likely as its haunts are in large part quite inaccessible and likely to remain so.

Since about 1870 Keas have shown a considerable increase in numbers. More than likely this increase is due to an increased supply of food corresponding with the Kea's discovery that the settlers' sheep provided an easy means of obtaining unlimited quantities of meat and fat. With the increase in numbers the Keas overflowed from their mountain habitat and came down to the lowlands on both sides of the alps. They also spread north and by 1904 had reached the north coast of Nelson. In spite of the many thousands of Keas that have been killed because of their attacking sheep they are fairly numerous in several districts. Their nests are hidden so well among the crevices of the mountains that there is probably a very low rate of mortality among the nestlings.

Food. The natural food of the Kea includes various vegetable substances and small animals, such as insects and their larvae and worms, which it extracts from under stones and among vegetation on the ground. Of fruits it eats the mountain coprosmas, totara, aristotelia, bog pine, gaultheria and others. Nectar is sucked from flax and other flowers; the young shoots of plants are eaten and also the succulent roots which are a feature of mountain plants adapted to withstand a period of growth inactivity. The species of ranunculus, aciphylla, celmisia and chrysobactron are sought out by the Kea for their roots.

Voice. Like the kaka, the Kea has a variety of cries. The characteristic call is that from which the name kea is derived, namely, a plaintive 'Kee-e-ah," the latter part in a lower tone than the first.

Nesting. The nesting site of the Kea is a deep crevice or fissure in some mountain crag. "The birds choose a natural tunnel in the rocks," writes Marriner, "one with a narrow opening, just wide enough to allow them to pass in and out, and then place a few pieces of tussock grass at the far end where the female lays her eggs." This nest was six feet and another one on the opposite side of the ravine ten feet from the entrance. In a nest found by E. F. Stead the eggs were laid on the ground among a few chips of rotten wood and bark, about five feet from the entrance of the hole. The usual time for the eggs to be laid is July, the very depth of winter, which in alpine country is especially severe. The nest found by Stead, however, contained four eggs in January, and eggs have also been found in November, and young in June and September. The young, according to Marriner, remain in the



Upper Poulter River *R. Cleland*

KEA CHICK

nest until they are fully grown, three months or more. A few years ago a nest was found in the mountains above Lake Sumner. On September 20th it contained two eggs and two newly hatched chicks but after a prolonged snow storm there was only one survivor.

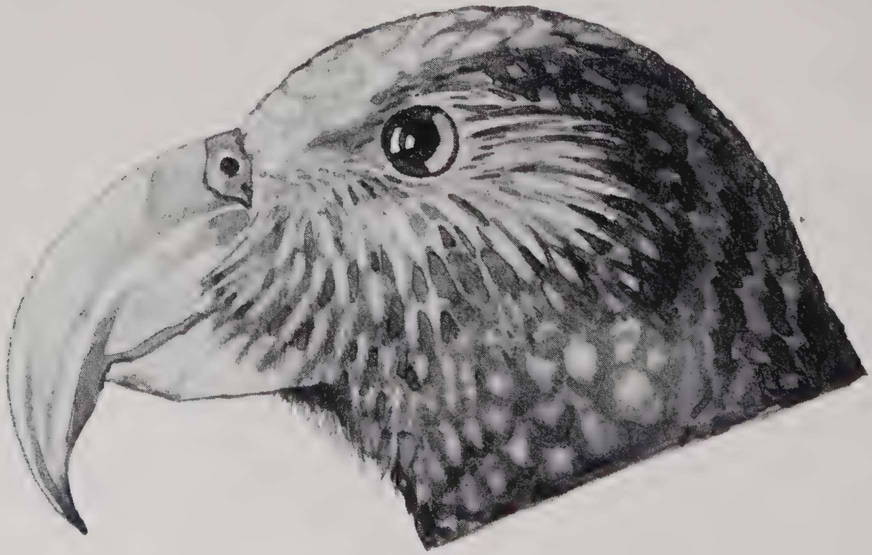
The probability that the Kea's normal nesting season is the summertime is indicated by a nest found by Professor McCaskill and Mr. R. Cleland in beech forest at an altitude of 2,200 feet near Lake Minchin in western Canterbury. An account of this discovery has been supplied me by Professor McCaskill. He says: "The nesting tunnel, about two feet long, passed under the arching roots of a beech tree, under some loose rubble disturbed by the fall of a tree long ago, and into a chamber about four square feet in area. In the chamber was the parent bird and three young in the downy stage." The date was January 29th, 1954, and one of the young birds is shown in Mr. Cleland's photograph here reproduced. Professor McCaskill states that six of the wing feathers of each young bird were quite well developed. "The most startling part of the young was the bill and the surrounding tissue, all of which was a lovely yellow shade."

References.—Gould, Proc. Zool. Soc., 1856, p. 94 (*Nestor notabilis,* Murihiku). Potts, Trans. N.Z. Inst., 3, 86, 1871; N.Z. Jour. Sci., 2, 481, 1885. Buller, Birds N.Z., 52, co pl. 1872; 2nd 1, 166, col. pl. 1888. Benham, Trans. N.Z. Inst, 39, 71, 1907. Marriner, Trans. N.Z. Inst., 39, 271, 1907; The Kea, 1908. Myers, N.Z. Jour. Agr., 29, 25, 1924. Shufeldt, Emu, 18, 25, 1918 (skeleton). McCaskill Notornis, 6, 24, 1954.

North Island Kaka

Nestor meridionalis occidentalis

Banks in his Journal of Cook's first voyage mentions a Maori cloak ornamented with the red feathers of a parrot. The parrot was certainly the Kaka. Banks does not give the locality but probably it was the North Island. Crozet, when at the Bay of Islands in 1772 noticed "in the forests, very big parrots with black and variegated blue and red plumage," not a good description but undoubtedly referring to the Kaka. In 1835 Yate gave a brief account of the Kaka, mentioning its food, breeding habits and cry, and in 1840 it was seen in the forest at the



E. H. Atkinson

NORTH ISLAND KAKA

Bay of Islands by the naturalists of the American Exploring Expedition. Hector found the North Island Kaka in the country between George and Milford Sounds in the South Island when on a geological expedition in 1862, and Reischek collected it in Dusky Sound in 1884 and in Chalky Sound in 1887.

It was early noticed that the North Island Kaka differed from the common one in the South Island and, on the assumption that the name *meridionalis* given by Gmelin referred to the North Island form which was better known, several names were given the South Island bird. In 1896, however, Lorenz showed that Gmelin's name was in reality given to a South Island bird so he named the North Island Kaka *Nestor septentrionalis.* There is, however, an earlier name, *occidentalis*, given by Buller to a specimen of this kaka from the sounds of western Otago. I do not know where the type specimen of *occidentalis* is preserved but that this subspecies is occasionally found in the South Island may be accepted as, besides the two specimens which Hector brought back from the country between George and Milford Sounds, there are in the Dominion Museum two specimens collected by Reischek, one from Dusky Sound and the other from Chalky Sound. Consequently as in the first edition I am using the name *occidentalis* for the North Island Kaka, for Buller's description is correct for the North Island bird.

Adult. Forehead grey; top of head and hind neck brownish grey, the feathers edged with dark brown; on the lower hind neck a narrow collar of crimson, each feather edged with dark brown; remainder of upper surface olive brown, the feathers tipped with dark brown; lower rump and upper tail coverts crimson. Facial disc behind the eye reddish orange, below the eye crimson with brown edges to the feathers; breast greyish brown with dark brown edges to the feathers; abdomen and under tail coverts crimson, the feathers centred and some faintly barred with brown; under wing coverts and axillaries bright red barred with brown; inner webs of quills notched with pink; inner webs of tail feathers stained and notched with red. Bill slaty black, cere yellowish. Iris dark brown. Feet slaty black. Bill 43-45, wing 260-280, tail 150-167, tarsus 30-34, longer fore toe 46-51 mm. *Nestling* covered with white down, short on the underparts, abdomen bare. Bill whitish grey, cere pale yellow. Feet dull cinereous. (Buller.)

J. Pattison

NORTH ISLAND KAKA

Colour Varieties. The Kaka is particularly prone to change its brown colour to white, yellow or red, and on the dominance of each of these colours three principal groups may be defined, with a fourth group for mixed brown, red and yellow birds: (a) To the first group belong birds which are creamy white or pale yellow and with red the same as in the normal birds. Of these, Rowley figures a specimen and Buller describes another form, Tongariro (var. *e*). (b) Canary yellow is the dominant colour, with red as in normal birds. This group differs from group (a) in the more intense colour of the yellow. It corresponds with the form *superbus* of Buller founded on a South Island Kaka. A specimen is described by Buller from the Tararua Range. (c) Dominant colour red. These beautiful birds are known to the Maoris as kaka-kura. Buller described specimens from Wanganui and Hawke's Bay, figuring the latter in the second edition of his work. (d) Some colour varieties retain a considerable amount of the brown colour and with it is mixed much yellow and red. A specimen from Manawatu of the variety known to the Maoris as kaka-pipiwarauroa is described by Buller (var. *i.*).

Eggs. Clutch four, broadly ovoid, almost elliptic, white, 39.5 x 30.2, 42.6 x 31.2, 44.2 x 31 mm. Chicken Islands.

Status. The North Island Kaka is distinguished from the South Island subspecies by its smaller size, narrower crimson collar, brownish grey crown, and brown tinged with green back, wings and tail. These differences are mainly degrees of coloration and so I have treated the two forms as subspecies instead of species as I did in the first edition of this book.

Distributions. North Island. Formerly abundant throughout, now scarce in most localities, especially so on the mainland north of Auckland though there are recent records from Mangamuka and near Whangarei. Recently reported in Auckland city. Mokohinau. Hen and Chickens. Little and Great Barrier Islands. Poor Knights, occasional. Mayor Island. Kapiti. South Island. Occasional in Nelson, Westland and western Otago, George Sound, Chalky Sound, Dusky Sound.

That the North Island Kaka was formerly present in the South Island, with the South Island Kaka, is the conclusion arrived at by E. W. Dawson after a study of subfossil bones obtained in the following localities: Takaka, Wairau coast, Pyramid Valley, Moa Bone Point, Pareora, Kapua, Long Beach, Castle Rock.

Ecology. The North Island Kaka is only found where there is a considerable area of forest, and generally frequents the upper tier of foliage. Here flocks work together, all the time uttering their harsh cries and obtaining their food, while one bird takes up a position of vantage or flies round the others and warns them on the approach of danger. On the signal being given, they move off high above the forest to another locality. E. T. Frost has the following note on the migrations of the North Island Kaka: "It was known to the Maoris that kakas had their local migrations and plans were made accordingly to trap them while on these journeys. One line of flight which continued for a while after white settlers had started to take up land, was between the forest land north of the Manukau Harbour and the great forest areas south of the Waikato River. There were certain places favoured by the birds for landing and here the Maori prepared his trap." The rapid disappearance of the forest following on the settlement of the North Island by Europeans caused widespread destruction among this very abundant species. Bush fires added to the areas in which the Kakas were unable to exist. Of introduced animals W. W. Smith says that rats and stoats were the worst enemies of the Kaka, while Guthrie-Smith states that bees sometimes occupy the hollow trees where the Kakas used to nest.

Food. A considerable portion of the Kaka's food is formed of grubs, the larvae of moths and beetles, which it digs out of the ground and of rotten logs or dead standing trees. Its powerful bill enables it to break up partly decayed wood or even the living wood of some species. There are many kinds of succulent fruits on which the Kaka feeds, among them miro, kahikatea, matai, puriri, poro and tawa. Seeds of the kauri, tawari, matipo and others are cracked and eaten. The Kaka's strong beak is used to break up the cones of the kauri in order to extract the seeds. With its brush tongue the Kaka is able to suck up the nectar of flowers of which the kowhai, puriri, rata, pohutukawa, rewarewa, flax and others provide supplies. Introduced plants such as eucalypts are visited for their nectar and orchard fruits do not come amiss as food if an opportunity of taking them offers.

Voice. The Kaka is rather a noisy bird. While feeding it continuously utters its harsh screech but when flying its cry is less harsh. Like its southern relative it has, as

Andersen has observed on Kapiti Island, a crooning song at breeding time.

Nesting. The favourite nesting site of the Kaka is a hollow tree. The bird enters by a hole in the outer sound wood and forms its nest of decayed wood from the interior, to which is sometimes added pieces of dry bark. Here the eggs are laid in November and December. Sometimes, according to J. G. Garland, three or four eggs are laid but only one or two hatch out. This observation is similar to one made by Henry on the South Island Kakas on Resolution Island. On Kapiti Island Wilkinson says that Kakas resort to the same nesting place for years. Both Yate and Buller state that, according to the Maoris, two females attended by one male sometimes breed in the same cavity. There are two nests placed side by side. The feeding of the young was once watched by Andersen on Kapiti. He stated that the young bird was perched on a branch below the parent, which seized the former by the bill and apparently shook it. The shaking, however, was evidently the act of regurgitation.

Maori. The Kaka was an important article of food for the Maori, while its red feathers were much used in the manufacture of cloaks. They were woven into a flax base either alone or as part of a design in which other coloured feathers were used. Kakas were captured in large numbers by various methods. The following account is based on Elsdon Best's description in *Sketches from Tuhoeland.* The principal method was snaring with the aid of a mutu kaka. This was a perch and snare combined, formed of a forked branch often ornamented by carving. Having ascended a tree to a stage previously built, the fowler places several mutu in position with the cords within reach of the platform. His well trained decoy, or mokai, soon by its cries attracts any Kakas within hearing, and as each bird settles on a perch the hunter jerks the appropriate cord and fastens it to the pole. He then takes the pole down and kills the bird by biting its head. Other methods of taking Kakas were spearing and striking with a stick birds attracted by a decoy or gorged on miro berries.

References.—Buller, Ibis, 1869, 40 (*Nestor occidentalis,* West Coast Sounds); Birds N.Z., 50, 1872. Lorenz, Verh. Zool. Bot. Ges. Wien., 193, 1896 (*Nestor septentrionalis,* North Island). Buller, Birds N.Z., 39, 1872 (part); 2nd ed., 1, 150, 1888 (col. pl. red variety and part text); Suppl. 2, 69, 1905 (main part). Rowley, Orn. Misc., 1, 28, col. pl. 1875. Dawson, Emu, 52, 259, 1952. Wilkinson, Kapiti Bird Sanct., 43, 1952.

South Island Kaka

Nestor meridionalis meridionalis

The South Island Kaka was first discovered at Dusky Sound in 1773 during Cook's second voyage. Forster noted that it was very noisy with a high and clamorous voice and that it lived on fruits and seeds. It was taken at Queen Charlotte Sound during Cook's third voyage in 1777 and then for about 80 years little was heard of it. After this, the investigations of Haast, Hector, Buller and Potts began and several beautiful specimens were procured.

Adult. Forehead and crown greenish white, faintly bordered with pale green; nape pale green, the feathers edged with yellowish brown; hind neck crimson variegated with

Stewart Island *H. Guthrie-Smith*

SOUTH ISLAND KAKA

yellow and brown; back and wings brownish green, some of the feathers of the mantle and wing coverts with a red border and all except the quills edged with blackish brown; rump and upper tail coverts crimson barred with blackish brown; tail brownish green, the terminal portion dark brown and the tip ferruginous. Facial disc golden yellow behind, red with whitish streaks below; foreneck and breast greyish or reddish brown, the feathers bordered with dark brown; abdomen and under tail coverts crimson barred with dark brown; under wing coverts and axillaries vermilion, quills notched on their inner webs with yellowish pink. Bill dark grey. Iris dark brown. Feet bluish grey. Bill 48-57, wing 290-300, tail 165-190, tarsus 30-36, longer fore toe 50-64 mm. *Nestling.* Covered with thick grey down.

Colour Varieties. The South Island Kaka seems to run into a greater number of forms than the North Island Kaka. They may, however, be grouped in a similar way (a) White or cream with red as in normal birds. Several specimens have been obtained from Nelson and Otago. A specimen from Stewart Island is fawn coloured. (b) Yellow with the red as in normal birds. Buller's *N. superbus* was an alpine form. A similar bird is figured in his *Supplement,* Plate VIII. In the Canterbury Museum is a bird which is mainly yellow, that is, the crimson as well as the green has disappeared. (c) Red dominant. A beautiful specimen from Stewart Island is in the Southland Museum, Invercargill. (d) Partly normal but with much more yellow and red, especially on the under parts. At least six specimens of the form described as *N. esslingi* have been taken in the Marlborough and Nelson districts. There is a broad yellow band across the lower breast and much red and yellow on the upper breast and elsewhere. The whitish crown and greenish wings and back are as in ordinary South Island birds. A specimen is figured in Buller's *Supplement*, Plate VIII.

Eggs. Clutch four, sometimes five, broadly elliptic, very slightly ovoid, surface slightly rough and finely pitted. 41.5 x 32, 42 x 30 mm. Dusky Sound. 44.6 x 30.6, 42 x 32.2 mm.

Status. The deep, grooved bill, crimson nuchal collar and abdomen, reddish facial disc, and other characters, separate the Kaka from the Kea. A species related to the Kaka is *N. productus* of Norfolk Island, now extinct, but it differs among other features, in the produced upper mandible, and yellow throat and chest. *N. meridionalis* as here understood comprises two subspecies. The South Island Kaka, *N. m. meridionalis,* is larger than the North Island subspecies, *N. m. occidentalis,* has more grey on the forehead and crown, while the back, wings and tail are brownish green instead of brown or greenish brown.

Distribution. South Island. Chetwode Islands, Stewart Island. Not uncommon in forest areas. Apparently this species sometimes crosses Cook Strait to the North Island as the description given by Buller of two specimens from Wellington and Otaki, as Kakakereru (Var. *0*) agrees with that of the South Island Kaka, while a bird that visited New Plymouth in 1953 was described as having a "silver streak" on the top of its head.

Ecology. The South Island Kaka, like its northern relative, is now found only in the larger forested areas. Formerly it was exceedingly abundant throughout the South Island forests. In the sixties of last century, as recorded by Gillies, Kakas appeared in the settled parts of Otago in considerable numbers. They came into the cleared country, settled on fences, stacks and ridges of houses as close together as they could sit. The damage they did to stacks and thatched buildings was quite serious, but the birds did not again return in menacing numbers and within twenty years the Kaka had practically gone from eastern Otago. There is of course no doubt that the decrease in the numbers of Kaka throughout the South Island was due to the clearing of forest. According to E. F. Stead Kakas were present on Mount Herbert, Banks Peninsula, until 1912 but opossums in increasing numbers brought on their extinction there. Recently there have been reports concerning damage by stripping the bark from introduced trees in Stewart Island where the Kaka is still abundant. The Kaka must be accounted a useful member of the forest community as an agent in pollinating trees and destroying harmful insects.

Food. Fruits of all kinds from the lofty miro and matai of the lowland forest to the stunted coprosmas of the alpine zone; nectar of flowers, kowhai, rata, flax, nothopanax and others; grubs dug out of the ground, decaying wood or the bark of living trees; and seeds form the principal food of the South Island Kaka. One foot is frequently brought into use to hold the branch or flower while the bird is extracting the nectar. According to W. T. L. Travers the habits of the Kaka are similar to those of the Kea. The Kakas at Lake Guyon were inquisitive, and came inside the hut and fossicked for food. They were fond of raw flesh and ate pieces of sheep's pluck hung on a tree. Kakas have been reported as eating fruit in an orchard and damaging fruit trees by eating the flower buds.

Voice. The South Island Kaka is as noisy a bird as its North Island relative. Besides harsh discordant screeches it emits on occasions a clear rather musical whistle. Henry in an interesting account of the birds of Dusky Sound writes regarding this species: "They have a greater variety of notes and calls than any other bird in the bush, and I would not be surprised if they had what might be called a language and could discuss a simple subject as well as a parish council. All the other Kakas knew what the parents were saying when I took their young ones." It has been noticed by several observers that the note of the Kaka varies from district to district. Also, besides the harsh notes characteristic of this bird, it has more melodious flute-like notes which the male sings to the female when approaching the nest or the female croons to the chicks.

Nesting. As a result of observations made during visits at different times of the year to Rakiahua Valley, Stewart Island, Guthrie-Smith found that the Kakas moved down to the lowlands and coastal woods in spring. Evidently the increased food supply in the way of nectar and insects attracts them during the breeding season. The nest is placed within a hollow tree, the eggs being laid in a depression in the powdered wood that fills such cavities. Four eggs are laid. The breeding season extends over a considerable period, eggs being found from October to February. According to Henry seldom more than two chicks are reared.

References.—Gmelin, Syst. Nat., 333, 1788 (*Psittacus meridionalis,* Dusky Sound). Potts, Trans. N.Z. Inst., 3, 81, 1871. Buller, Birds N.Z., 39, col. pl. 1872; 2nd ed., 1, 150, col. pl. 1888; Suppl., 2, pp. 69, 77, col. pl. 1905 (*N. meridionalis, N. esslingi*). Guthrie-Smith, Mutton Birds, 72, 1914.

FAMILY STRIGOPIDAE. KAKAPO

Bill stout, deeper than long, under side of hook with file-like surface; lower mandible longitudinally ridged.

A single genus confined to New Zealand.

Genus Strigops

Cere swollen. Cutting edge of upper mandible with shallow sinus near tip. Shafts of feathers at base of mandible prolonged into hairs. Wings rounded, fourth and fifth quills longest. Tail rounded.

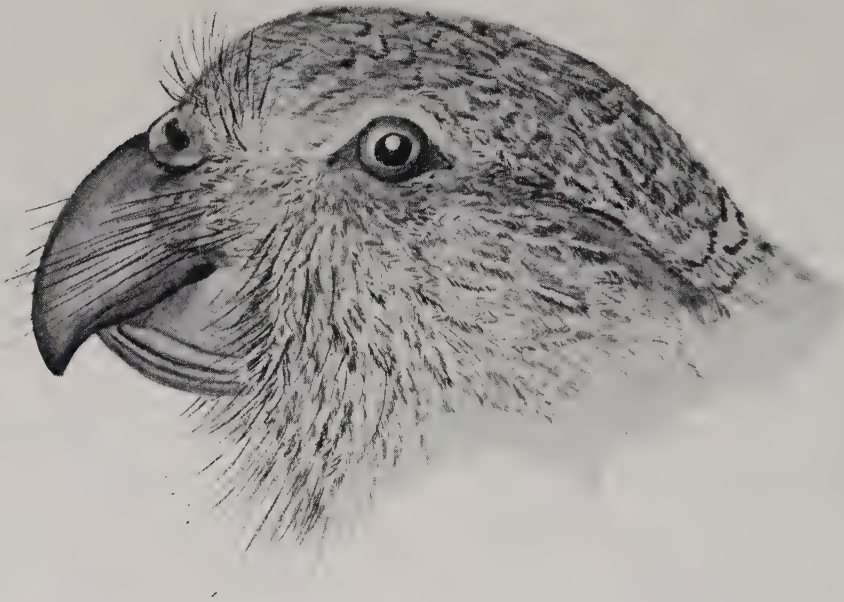
Strigops differs from all other parrots in the strongly ridged lower mandible and the rudimentary keel to the sternum.

Reference.—Gray, Gen. Birds, 2, 426, 1845 (*Strigops,* type *S. habroptilus* Gray).

Kakapo

Strigops habroptilus

Although the Kakapo is mentioned by Dieffenbach in his *Travels in New Zealand* published in 1843, he had not seen a specimen. The first skin to come into the hands of Europeans was obtained at Dusky Sound and forwarded to England in 1845, and was described and figured by Gray in his *Genera of Birds.* In 1851 a specimen was obtained at Milford Sound by Captain Stokes and presented to the British Museum;



C. McCann

KAKAPO

and in the following year Dr. Lyall contributed to the Zoological Society an account of the Kakapo's habits. The species was found to be quite numerous by both Hector and Haast on the West Coast of the South Island in 1861-62.

Adult. Upper surface sap green, irregularly cross-banded with black, the feathers except on the crown with yellow centres; greater wing coverts, quills and tail feathers brownish buff mottled and barred with black. Forehead and facial disc yellowish brown, the feathers with light centres and darker tips; under surface pale greenish yellow irregularly barred with lemon-yellow and dark brown; under surface of wings blackish brown mottled and barred with pale yellow. Bill yellowish white. Iris black. Feet yellowish brown. Bill from cere 34-40, wing 265-295, tail 230-260, tarsus 45-50, longer fore toe 60-76 mm. *Nestling.* Covered with white down which in about a month's time gives place to feathers, the down remaining on the feathers until the birds are about three months old. (Reischek.) *Colour Varieties.* Colour mutation in the Kakapo usually takes the form of yellow replacing the green. In some cases the green only becomes pale yellow and the plumage is barred with brown, in others the entire plumage is canary-yellow. One specimen of unknown locality and described as *Strigops greyi,* differed from normal examples in the greenish blue edges to the feathers of the upper surface, whitish bands on head feathers, greyish white forehead and cheeks, and whitish rump and thighs.

Eggs. Clutch three or four, ovoid, finely granulated, white, 49 x 35.4 mm. Okarito. 54.5 x 36.4, 53 x 37.6 mm. (Canterbury Museum.)

Status. Individuals vary in depth of colour and in details of the colour pattern. There is also a considerable amount of difference in size. Based on size Mathews and Iredale accept three subspecies: *S. h. habroptilus,* South Island; *S. h. innominatus,* North Island; *S. h. parsonsi,* South Island, alpine, wing 335 mm. Investigation is required to determine the value of this grouping.

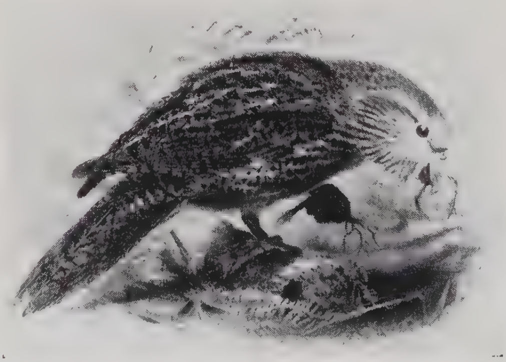
Distribution. North Island: formerly widely distributed, at least from the Pirongia Range and East Cape southwards to the Tararua Range. Now, if still existing, confined to the central mountain ranges, but no records since 1906, when one was caught in the Kaimanawa range. South Island: the northern and western portion, still plentiful in the larger areas of forest. Stewart Island.

Said at one time to have been common in the Chatham Islands. Bones have been found in moa hunters' beds at Moa Bone Point and Castle Rock. Three birds were transferred to Little Barrier Island in 1903, and three to Kapiti Island in 1907.

Ecology. The stronghold of the Kakapo is the forest, mainly the beech forest of the northern and western portion of the South Island from sea level to the upper forest line. Here it hides during the day in holes among rocks or beneath the roots of trees. It is seldom seen abroad during the daytime but occasionally does leave its retreat as several observers have recorded it and I have myself seen it in the dense forest above Doubtful Sound. At night it comes out to feed and roams, often far from its abode, out in the open tussock country above the forest line or on the grassy patches of the river flats. It travels along well marked paths which it keeps open by picking off any roots or twigs that might be in the way. The Kakapo is a ground bird which runs at a good pace and when pressed sometimes opens its wings. It climbs trees for their fruit or nectar but does not fly. Instead it glides to the ground. The longest distance it is known to have glided is ninety yards. It is said to climb trees merely for the pleasure of making glides.

The Kakapo has suffered heavily since the occupation of the country by Europeans. Possibly it has been entirely eliminated in the North Island, and it has disappeared from large areas in the South Island though it is still found in fair numbers in the forested mountainous regions of the western side of the island. The main causes of its disappearance are the clearing of the forest and the introduction of mammals by Europeans. These include pigs, cats, dogs, stoats, ferrets and rats. Against these this ground feeding parrot has little chance of continuous survival. As with other peculiar New Zealand birds collectors for museums took a heavy toll of Kakapos in the last quarter of last century.

Food. The Kakapo is almost entirely a plant feeder, only on one occasion has any animal food, namely lizards, been found in its stomach. It is fond of the berries of tutu, konini, hinau and tawa, many of which it finds on the ground. According to Henry it sucks nectar from rata flowers. Its principal food, however, is leaves, young shoots, especially those of the toii, and moss of which it consumes large quantities. It masticates the leaves of snow grass and the leafless twigs of Carmichaelia and extracts the juice without detaching them from the plants. Its presence in a locality can therefore be detected by these signs. According to A. P. Harper, Kakapos collect a large amount of vegetable matter in their crops by skinning the snow grass leaves with their strong beaks and then retiring to their sleeping places to chew it until all the juice is extracted. They then eject the fibre in dry balls. Bracken fern rhizomes are eaten and it is reported that the Kakapos store some of them for future use. "When several are



From Buller, Birds of New Zealand
KAKAPO

feeding together," writes W. W. Smith from Lake Brunner, "they continue throughout the night to answer each other's calls, or hoarse mutterings, uttered while masticating their food. By the morning their crops are enlarged to their full extent with the nutritious green food consumed during the night. When their hunger is appeased they return to their usual hiding place generally in or about the decayed roots of old trees or hollow prostrate trunks."

Voice. A variety of sounds is made by the Kakapo. When feeding, it emits grunting noises, and it occasionally utters a harsh scream. Most peculiar, however, is the booming of the male. Henry states that it is only heard every alternate year when the birds breed, and that months before the breeding season the male develops an air sac in its throat which can be puffed out like a drum. "They start with a couple of short grunts, and then utter five or six deep measured notes like the sound of a muffled drum, the loudest in the middle. The male repeats this series about three times in the daylight and is then silent, and other Kakapos, perhaps miles away, take up the sound."

Nesting. The nesting place of the Kakapo is described by Potts as "usually a hole either ready made or one which requires but little labour to fit it for use, such a place is often selected amongst roots or dead trees; sometimes its home is tunnelled in the ground. A well excavated home not far from Okarito was . . . six inches in diameter at the mouth, widened very gradually as the excavation extended, the work ending in a chamber two feet in height, by eighteen inches in width; the entire length of the hole from the entrance to the back of the nesting-place was found to measure nine feet. Three eggs seem to be the complement. These laid probably with a considerable interval between each; the breeding season extends through the first three months of the year; I have a note of a nest found in March, on the banks of the Okarito River, which contained one egg and two young birds; a second nest contained two eggs and one young bird." Apparently incubation is carried out by the female and, according to Henry, the Kakapo breeds only every second year, all breeding one year and none the next. At Dusky Sound in April Reischek found in a burrow two young Kakapos, and on May 12th Mr. Dougherty found a Kakapo's nest containing a female sitting on an egg with a chick just hatched. Reischek continues: "The burrow had an entrance from two sides, and two compartments. Both entrances led to the first compartment, the second chamber being connected with the first by a small burrow of about a foot. The nest was in the outer compartment. The distances from the entrances to the nest were two feet and three feet respectively. The nest was formed by a deepening, lined with wood dust and feathers, which the female had evidently plucked from her own breast, which was quite bare. From my observations I am of opinion that the male bird takes no part in the hatching or rearing of the chicks, as in all cases the female was the sole attendant from first to last."

References.—Gray, Gen. Birds, 2, 427, col. pl. 1945 (*S. habroptilus,* Dusky Sound). Buller, Birds N.Z., 26, col. pl. 1872; 2nd ed., 1, 176, col. pl. 1888; Suppl., 2, 89, 1905. Haast, Ibis, 1864, p. 340. Potts, N.Z. Jour. Sci., 2, 479, 1885. Reischek, Trans. N.Z. Inst., 17, 195, 1885. Henry, Flightless Birds N.Z., 18, 1903. Mathews and Iredale, Ibis, 1913, p. 427.

FAMILY PSITTACIDAE
PARROTS, PARRAKEETS

Bill deeper than long, inside hook with file-like surface, lower mandible curved upwards, smooth.

The New Zealand Parrakeets all belong to the genus Cyanoramphus.

Genus Cyanoramphus

Bill with upper mandible swollen at sides, not notched, base pearly; lower mandible angular. Second and third quills longest. Tail long, graduated. Males are larger than females.

Distinguished from Platycercus by the abscence of a notch on the upper mandible and the uniform green colour of the back. There are six species found in New Zealand, Lord Howe Island, Norfolk Island, New Caledonia and the Society Islands.

Key to New Zealand Species

Forehead and crown red	*C. novaezelandiae*
Forehead red, crown yellow	*C. auriceps*
Forehead orange, crown yellow	*C. malberbi*
Entirely green	*C. unicolor*

Reference.—Bonaparte, Rev. Mag. Zool. (2), 6, 153, 1854 (*Cyanoramphus*, type *Psittacus erythronotus* Kuhl).

Kermadec Islands Parrakeet

Cyanoramphus novaezelandiae cyanurus

In 1788 when the transport *Lady Penrhyn* was on a voyage from Sydney to China, Macauley and Curtis Islands of the Kermadec Group were discovered, and on Macauley Island parrakeets were noticed, but the first specimen to be collected in the group was obtained on Raoul Island by Captain Denham of H.M.S. *Herald* in 1854. Mr. T. Bell, who resided on Raoul Island for many years, said that parrakeets which formerly bred on Raoul Island had been exterminated there by cats introduced by visiting ships. The birds now breeding on Meyer Island, however, occasionally visit Raoul Island.

Adult. Similar to *C. n. novaezelandiae* but larger and with a blue tinge on the central tail feathers, also a considerable amount of blue on the primaries which have more blue than green on the outer web of the narrow portion of the feathers. Bill bluish. Iris red. Feet greyish brown. Bill 18-20, wing 140-167, tail 155-175, tarsus 20-22, longer fore toe 27-29 mm. *Colour Variety.* Buller records from Macauley Island a specimen with the abdomen greenish yellow and a ring of the same colour round the frontal crimson patch.

Eggs. Clutch three to five, broadly elliptical, white, opaque. 25.5 x 20.5, 26.5 x 20.5, 28.5 x 20 mm. Same clutch. Macauley Island.

Distribution. Kermadec Islands: Raoul Island, formerly breeding, now visitor from Herald Islets; Meyer and Napier Islets in the Herald group; Macauley Island; Curtis Island.

Habits. The Kermadec Islands Parrakeet is now found breeding only on scrub and tussock covered islands. On Meyer Island it is very common among the stunted ngaio and pohutukawa (*Metrosideros kermadecensis*) trees. It does not fly much nor rise far above the ground, yet it is able to fly from the Herald Islets to Raoul Island, a distance of not less than a mile. I heard but did not see parrakeets on Raoul Island in May, 1908, that is, after the breeding season was over on Meyer Island. A large portion of the food of this parrakeet consists of the seeds of the sedge toetoe-upuku-tangata (*Mariscus ustulatus*), the seed heads of which are two or three feet tall. The nests are in burrows in the ground and the eggs, of variable sizes in each clutch, are laid mainly in October and November.

On Macauley Island which for a long time has been denuded of scrub by goats and supports only short grass, Cheeseman, in 1887, found the Kermadec Islands Parrakeet "in great numbers, going about in flocks of from twelve to fifty, hopping among the short grass and apparently feeding on the seeds of *Erigeron* and *Gnaphalium*. So tame was it, and so unused to man's presence, that I caught two by simply walking quietly up and suddenly putting my hat over them while they were walking on the grass."

Reference.—Salvadori, Ann. Mag. Nat. Hist. (6), 7, 68, 1891 (*Cyanorhamphus cyanurus* Raoul Island). (Probably Meyer Island.)

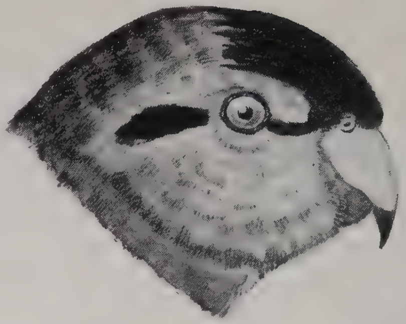
Red-fronted Parrakeet. Kakariki

Cyanoramphus novaezelandiae novaezelandiae

When Captain Cook put into Dusky Sound during his second voyage, this pretty little parrakeet was collected by both Sparrman and Forster. Sparrman was the first to describe it so that it is his name that ornithologists adopt. Forster stated that it was found throughout the South Island, meaning by this that it was seen at both the localities, Dusky Sound and Queen Charlotte Sound, where Cook touched during his second voyage, and that it lived on fruits, especially Muehlenbeckia. The species was obtained at Queen Charlotte Sound in 1777 during Cook's third voyage. Yate mentions parrakeets in 1835 in his account of the birds of the Bay of Islands, but the first specimens to be sent to the British Museum seem to be those collected by the British Antarctic Expedition which visited the Auckland Islands in 1840.

Adult. Forehead, crown and streak through the eye expanding behind deep crimson; upper surface bright green; a spot of crimson in each side of the rump; primary coverts and second to fifth primaries deep violet-blue on their outer webs, dark brown at tips and on inner webs; tail dark green with the outer margins of the feathers yellowish. Under surface yellowish green. Bill pearly bluish white with a black tip. Iris red. Feet pale brown. Male: Bill 16-20, wing 130-135, tail 130-170, tarsus 18-21, longer fore toe 26-27. Female: 14-15, 126-128, 130-140, 18-20, 23 mm.

Colour Varieties. As with most green coloured birds, some very beautiful colour varieties are produced. In most cases the green gives place to some other colour but the red and violet remain. Generally it is yellow that replaces green, either over the whole body or partially so. A canary coloured bird with the red and violet parts remaining normal was obtained at Seaward Bush. Similarly coloured parrakeets have been taken in other localities. A bird entirely greenish yellow, except for the red and violet parts was obtained at Invercargill. There are several instances of Red-fronted Parrakeets in which yellow feathers are developed irregularly among the green. Buller describes a specimen from Auckland in which the back, rump and upper surface of the wings are irregularly marked with yellow and the tail is entirely yellow. There is a specimen in the British Museum with most of the yellow feathers on the lower surface, but the tail is obscurely banded above with dull yellow. Other than these varieties with yellow in their plumage two remarkable colour varieties have been taken. One from Southland in the Otago Museum is greenish blue, paler below, and with dark blue wings. The parts usually red are bluish grey, but the violet blue patches and the brown on the wings are normal. The other specimen, reported by Buller from the Kaipara district, "had the whole of the plumage of a brilliant scarlet red." Finally a specimen from the neighbourhood of Wellington had the whole plumage "thickly studded all over with spots of red," but the spots did not reappear after the first moult.


B. Osborne

RED-FRONTED PARRAKEET

Eggs. Clutch three to ten, average about five, broadly elliptical, white, 24.5 x 22, 25 x 21.5 mm. Poor Knights. 25.4 x 21.2, 26 x 20.8, 26.6 x 20.5 mm. Jacky Lee Island, off Stewart Island.

Status. The species *Cyanoramphus novaezelandiae* comprises seven subspecies, one, *C. n. subflavescens,* in Lord Howe Island, now extinct; one, *C. n. verticalis,* in Norfolk Island; one, *C. n. saisseti,* in New Caledonia; and four in the New Zealand region. The red markings easily distinguish this species from the three other species of the genus found in New Zealand. The four New Zealand subspecies are *novaezelandiae,* green without conspicuous emerald green on side of face; *chathamensis,* large and with emerald green on side of face; *cyanurus,* more blue on tail and wings; *erythrotis*, yellowish green.

Distribution. Throughout the North, South and Stewart Islands and the following offlying islands: Three Kings, Poor Knights, Great Barrier, Little Barrier, Hen and Chickens, Mokohinau, Alderman Islands, Mercury Islands, Kapiti, Codfish Island, Jacky Lee Island. Not very common anywhere. Auckland Islands, fairly common on Adams and Enderby Islands.

Ecology. On the main islands the Red-fronted Parrakeet is now mostly found in tall forest, and resorts mainly to the tops of the trees. It frequents as well the outskirts of the forest where it searches for fruits and seeds among shrubs and sedges. On the outlying islands it lives among scrub and tussock and such low forest as exists. In the seventies and eighties of last century the Red-fronted Parrakeet was extremely common and when for any reason, such as cold and wet weather or severe frosts, its food failed in the forests, it came out into the settled districts and attacked the farmers' and orchardists' crops. That food failure was the reason for these irruptions is indicated by the fact that in some districts at the same time there was also an invasion of native rats. In 1888 there was an irruption of rats and parrakeets in Marlborough. The Red-fronted Parrakeets were accompanied by smaller numbers of Yellow-fronted Parrakeets. On such occasions the parrakeets showed no fear of man who tried to lessen the damage they did by shooting the birds. The parrakeets, however, were not frightened very much by the sound of the guns. They merely flew a short distance away and continued their ravages on the crops. Nevertheless many thousands of them were killed and the total number of birds must have been considerably reduced. Two severe irruptions took place in Canterbury in the eighties and it was thought that the birds came from Westland driven out by the failure of the food supply on account of wet and cold weather. Describing one of these invasions consisting of Red-fronted and Yellow-fronted Parrakeets, Potts said that they appeared in great numbers in the spring and summer of 1884 "living on currants, strawberries, plums, pears, apples, &c.; in the autumn and winter feeding on sow-thistle, cocksfoot, acacia seeds, cones of *Cupressus funebris, Pinus pinea,* acorns, &c." Once when a fire burned an area of forest at Oxford the parrakeets swarmed over the Canterbury Plains as far as the city of Christchurch. Although parrakeets caused a great deal of damage to grain and fruit they also fed on the seeds of noxious weeds and so compensated somewhat for the farmers' losses. Parrakeets, according to J. Kilmister, were one of the worst of pests in the Hutt Valley during the early days of European settlement. They made serious inroads on the hop gardens of Nelson and on the wheat crops of Otago. After fifteen years or more of these visitations the number of parrakeets decreased considerably and they did not again recover. Now they are seen only by those who go into the forested regions or visit the outlying islands where they live.

Dr. Fulton, commenting, in 1908, on the disappearance of the Red-fronted Parrakeet, wrote as follows: "He came in flocks in the seventies; he was a scourge in the eighties; he was shot in thousands for his destruction of grain and fruit; then gradually he

Little Barrier Island *K. V. Bigwood*
RED-FRONTED PARRAKEET

seemed to disappear; and now he is rarely heard near civilised parts. Possibly the destruction of timber, the felling of the broadleaf tree, his favourite home; the attacks of weasels and rats, which can get into his nesting holes; the increase of bees in hollow trees; shooting by farmers; trapping by fruit growers, are all reasons why this pretty little parrot has gone."

Food. All kinds of seeds and, according to Wilkinson, buds are eaten by the Red-fronted Parrakeet. They include the toetoe and other grasses, flax (*Phormium*), rushes, toetoe-upuku-tangata (*Mariscus*), and other sedges, tauhinu, koromiko and such soft fruits and their seeds as konini, poroporo, tutu, mahoe and karo. In fact it will eat the seeds of any plant including naturalized species. On Kapiti Island, according to Wilkinson, it eats the minute seeds of the manuka and the nuts of a sedge with hooks on its fruit, matau-a-maui, *Uncinia uncinata.* On the Poor Knights toetoe (*arundo kakaho*) provides it with an abundance of seeds.

Voice. Parrakeets keep up an incessant chattering or chuckling while on the wing and when sitting on trees. Besides this, which may be rendered "tu-tu-tu," there are other notes in an ascending scale and sounding like "pretty dick," "do be quick," or "twenty-eight."

Nesting. The Red-fronted Parrakeet usually nests in holes in the decaying parts of the trunks or branches of trees or in dead trees. But it will use any protected place such as crevices in cliffs or among rocks, or in burrows in the ground. On the Poor Knights Island I found a nest in a burrow made in the dead leafy base of the large liliaceous plant *Xeronema callistemon.* In decaying trees the nest is a hollow lined with the pulverized wood usually found therein. Potts once found a nest, in a hollow in a tree, made entirely of green parrakeet feathers, moss and tree fern scales. Wilkinson says that parrakeets use the same nesting place year after year and quoted the case of a nest in a hollow cabbage tree that had been in use for fourteen years. Wilkinson continues: "Parrakeets lay eight or nine eggs. The female commences to sit within a day or two of the laying of the first egg, so the young are hatched out in succession, but all the young leave the nest about the same time. There is usually a marked difference in size among the family, due to the larger members obtaining more than their share of food." Parrakeets breed during several months of the year. Potts says that the Red-fronted Parrakeet "is an early breeder as it commences nesting almost in the winter; full-fledged young ones were taken from a felled tree in the Oxford forest in the month of August." Apparently most eggs are laid in October, November and December, but eggs have been found in March and April, while the young birds found by Potts in August would probably be from eggs laid in June.

References.—Sparrman, Mus. Carls., 2, No. 28, 1787 (*Psittacus novaezelandiae,* Dusky Sound). Buller, Birds N.Z., 58, col. pl. 1872; 2nd ed., 1, pp. 137, 147, 1888 (*Platycercus novae zelandiae,* col. pl., *P. rowleyi*); Suppl., 2, 83, 1905. Andersen, Bird Song, 191, 1926. Rowley, Orn. Misc., 2, 115 col. pl. 1877 (*P. rowleyi*). Wilkinson, Kapiti Bird Sanct., 45, 1952. Reichenow, Jour. f. Orn., 1881, p. 42 (*C. n-z. aucklandicus,* Auckland Is.).

Chatham Island Red-fronted Parrakeet

Cyanoramphus novaezelandiae chathamensis

The Chatham Island Parrakeet was discovered in 1840 by Dieffenbach, who stated that it was very common, in fact it flocked in hundreds to the potato fields when seed potatoes were planted and proved a great nuisance to farmers by picking them out of the ground. This parrakeet is still abundant in the southern portion of the main island and on South-east Island, but it was not always so for in 1892 Forbes reported that it was then not nearly so abundant as it was in Dieffenbach's time.

Adult. Distinguished from the New Zealand subspecies (*C. n. novaezelandiae*) by the sides of the head being emerald green, the large amount of blue on the wings, and its usually larger size. The plumage is green above, yellowish green below, with red patches on the forehead extending to the crown, behind the eyes, and on the flanks. Bill bluish. Iris yellow. Feet grey. Bill 16-20, wing 127-138, tail 120-160, tarsus 17-21, longer fore toe 22-26 mm.

Eggs. Clutch five to seven, 23.5 x 20.5, 26.5 x 21.5, 28.5 x 21 mm. (Fleming.)

Distribution. Chatham Islands. Wharekauri, the main island, mainly in the southern portion. Pitt Island. Mangere Island. South-east Island.

Habits. The Chatham Islands were visited by C. A. Fleming and E. G. Turbott in December, 1937. They camped for about two weeks on South-east Island and in his account of the birds of the Chathams Fleming states that South-east Island contains the greatest concentration of parrakeets in the group. He saw the birds feeding on the fruit of piripiri (*Acaena*) and on *Mesembryanthemum.* They also ate the fat and maggots found on sheepskins. Fleming found the nests of the parrakeet in holes in trees where the stem had rotted at the base of the branches. In late December eggs and well feathered young were present. On the main island: "on the southern boglands the birds feed on the purple centre of the *Olearia* flowers and the golden tree groundsel (*Senecio huntii*)."

References.—Oliver, N.Z. Birds, 412, 1930 (*C. n. chathamensis,* Chatham Islands). Fleming, Emu. 38. 501. 1939.

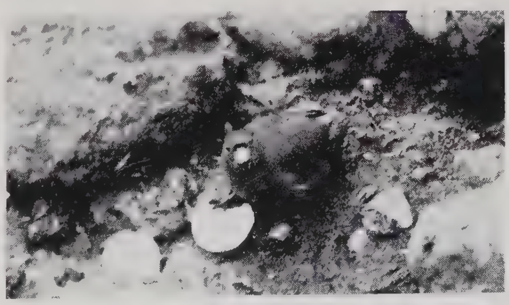
Macquarie and Antipodes Islands Red-fronted Parrakeet

Cyanoramphus novaezelandiae erythrotis

In the early part of the nineteenth century sealers on Macquarie Island killed large numbers of this parrakeet for food. They also captured a few alive and took them to Sydney for cage birds. When the Russian expedition under Bellingshausen called at Macquarie Island in 1820 the naturalists collected twenty parrakeets for museum specimens while a live one was bought from a sealer for three bottles of rum. The live bird was taken to Sydney where it and a black cockatoo were prized more than all the other live birds that were obtained during the expedition. In 1880 J. H. Scott visited Macquarie Island and reported the parrakeets as occurring in great numbers round the shore. Within ten years of this these parrakeets had become extinct. They were probably exterminated by cats which had been abandoned by the sealing gangs.

Andreas Reischek discovered this subspecies on Antipodes Island in 1888. Recognising its differences from the Red-fronted Parrakeet of New Zealand he described it as a new species. Thus the parrakeets of Macquarie and Antipodes Islands were described independently neither author comparing his specimens with birds from the other islands.

Adult. Dark yellowish green, the yellow being most conspicuous on the breast; yellowish crimson patch variable in size on forehead breaking up on the crown; streak in front of eye orange red; ear spots red, narrow; a scarlet patch on each side of the rump. A concealed patch of yellowish white on the hind neck. Outer primaries with the broad portion deep greenish blue on their outer webs in a band near the shafts succeeded by a band of yellowish green edged with greenish yellow. Primary coverts deep blue on their outer webs; spurious wing greenish blue the feathers with yellowish blue tips. Secondaries and tail feathers edged with yellow. Bill black except the base of the upper mandible which is whitish blue (pearly). Iris yellow or red. Feet



Antipodes Island *H. J. Ollerenshaw*

ANTIPODES ISLAND RED-FRONTED PARRAKEET

greenish brown, claws dark brown. Bill 19-20, wing 140-147, tail 140-152, tarsus 22-29, longer fore toe 29-31 mm. Antipodes Island. Measurements of Macquarie Island birds: Bill 15.5-21, wing 140-144, tail 137, tarsus 20-21 mm.

Colour Varieties. A yellow variety from Antipodes Island with wings and tail nearly white, but all the red parts of the plumage normal, was described by Hutton. Another colour variety from Antipodes Island has the bill ivory white; red patches normal; head canary yellow with a few green feathers; under surface mottled yellowish green and yellow; remainder yellowish green with yellow feathers on the wings; tail normal.

Status. Ornithologists have differed concerning the affinities of the Macquarie and Antipodes Islands Parrakeets. Forbes compared them and could find no differences between them. Rothschild and Buller agreed with Forbes. Lorenz thought they should be different subspecies because of the great distance between the islands, about a thousand miles. There being no authenticated specimens of the Macquarie Island Parrakeet in any New Zealand museum I applied to the British Museum and received a reply from Mr. J. D. Macdonald from which the following paragraph is extracted: "There are two specimens here of the race from the Macquarie Islands. The male specimen has been compared with five adult specimens of *hochstetteri* all of which appear to be male. This series shows slight individual variation in the amount of red on the head, and in other features. But in all these characters the male of *erythrotis* can be matched with at least one of the series. It differs from them only in having a few yellowish tips to some of the green feathers of the crown bordering the red patch. The presumed female of *erythrotis* is similar in colour to the male except that there is no yellow in the crown and the red patch is rather smaller. On the evidence of these two specimens, therefore, there seems to be no valid reason for regarding the Macquarie Island birds as a separate race." I have united the two forms under one subspecies in accordance with Macdonald's report but I think that the specimens brought from Macquarie Island by Bellingshausen should be studied and compared with a series from Antipodes Island before the question of the relationships of these two island parrakeets can be said definitely to be settled.

Distribution. Macquarie Island, extinct. Antipodes Island.

Habits. In 1880 when J. H. Scott visited Macquarie Island he said that the parrakeet "occurred in great numbers round the shore. Makes its nest under tussocks." This is the last direct observation on this parrakeet. Macquarie Island was visited by A. Hamilton in 1894 but he found no parrakeets. From some sealers on the island he gathered the information that the parrakeets frequented the shore where they searched for crustaceans and other small animals amongst the heaps of cast-up seaweed. According to sealers' reports in the early part of the nineteenth century the parrakeet laid its eggs in burrows in the ground.

In April, 1927, when I visited Antipodes Island Red-fronted Parrakeets were seen in the penguin colonies on the shore hunting among the rocks for food, as were also the Antipodes Island Green Parrakeet (*C. unicolor*) and the Southern Islands Pipit. Parrakeets were seen all over the island, in scrub and tussock, keeping near the ground. They flew only short distances. They were quite unafraid and allowed a close approach. The food of the Antipodes Island Red-fronted Parrakeet consists as far as is known mainly of plant substances: coprosma berries, leaves of grass, stitchwort, and coprosma (Guthrie-Smith), and heads of lycopodium (Waite). These birds clean up the broken egg shells of penguins after skuas have devoured the contents.

References.—Wagler, Abhand. Ak. Wiss. Munch., 1, 526, 1832 (*Platycercus erythrotis,* Macquarie Island). Gray, Ibis, 1862, p. 228. Reischek, Trans. N.Z. Inst., 21, 387, 1889 (*Platycercus hochstetteri,* Antipodes Island).

Yellow-fronted Parrakeet. Kakariki

Cyanoramphus auriceps auriceps

Very little of the early history of this species has been recorded. It was first described in 1820 from specimens collected in the South Island and, later, about 1850, examples were obtained by Miss Stone and the New Zealand Company.

Adult. Forehead crimson, crown golden yellow; upper surface bright green; a patch of crimson on each side of the rump; primary coverts and second to fifth primaries deep violet-blue on their outer webs, dark brown at the tips and on inner webs; tail dark green with outer margins of feathers yellowish. Under surface yellowish green. "Bill pale cobalt blue, tip of upper mandible and all lower mandible black. Iris reddish gold. Feet slaty black, claws black." (M'Lean.) Male: Bill 15-17, wing 110-127, tail 125-150, tarsus 18-20, longer fore toe 22-25 mm. Female: 13-16, 100-110, 90-120, 17-19, 21-24 mm.

Colour Varieties. Canary coloured birds with the red, violet-blue and brown parts normal have been obtained from Waimea, and Southland. From Manawatu came a bird in which the space round the eyes and a band round the neck were green; head, shoulders and lower part of back red, the intermediate space varied red and green; wing coverts greenish yellow barred with red; tail green obscurely barred with yellow; under surface green varied with red and yellow. The red, violet-blue and brown parts normal to the species had not altered. The remarkable feature about this specimen was the appearance of red elsewhere than in the normal positions. When this bird commenced to moult, however, the new plumage was the normal green.

Eggs. Clutch five to nine, broadly ovoid, white, 24 x 18.5, 24 x 20 mm. Codfish Island.

Status. The red front and yellow crown easily separate this species from the other New Zealand species of *Cyanoramphus.* Its nearest relative is *malherbi* which is smaller and has orange instead of red on head and rump. The subspecies *forbesi* differs in several respects from the typical *auriceps.*

Distribution. Formerly common throughout the North, South and Stewart Islands, and on Great Barrier, Little Barrier, Kapiti, Hen, Solander, Codfish Islands and Auckland Islands. It is now not common on the two main islands and seems to have disappeared altogether from the mainland north of Auckland. There are a number of recent records from forested districts from Waitemata Harbour to Foveaux Strait. Seen on the Three Kings in 1934 but not since.

Ecology. The Yellow-fronted Parrakeet is now confined to large areas of forest and generally keeps to the upper tier of foliage. Although it is usually found in association with the red-fronted species it does not accompany this species to all the islands where it is found. The Yellow-fronted Parrakeet associates with the Whitehead in the North Island and the Yellowhead in the South Island. According to M'Lean's observations in the Maungahaumia district it is the flocks of Whiteheads that lead and the parrakeets which follow. Thus M'Lean says: "The Yellow-fronted Parroquets have a habit of accompanying the flocks of Whiteheads (*Clitonyx albicapilla*), and in June and the following months this trait was observed almost daily. That they are very much attached to these little birds was noticeable on one occasion when, wishing to obtain a specimen, I disturbed a troup very much by shooting at a Parroquet in a tall birch full of Whiteheads. The birds went all ways, but the Whiteheads quickly reassembled in one birch and started off with their straggling flight to another. Then the Parroquets rocketed across and joined them, and all made off together. Shortly afterwards the Whiteheads were seen to turn and retrace their steps from tree to tree. This did not deter the Parroquets, who turned with them and all came on towards me and passed by. When any excitement is caused among these flocks the Parroquets remain chattering in the tops overhead until the noise subsides and the parties resume their advance."

The irruptions of parrakeets that occurred in the South Island in the latter part of last century included a fair proportion of Yellow-fronted Parrakeets which must at that time have been very common. Handly, writing of the invasions of rats and parrakeets into Marlborough in 1888, says that the Red-fronted and Yellow-fronted Parrakeets "haunted the neighbourhood of the villages adjacent to the bush and made themselves obnoxious to orchardists, in many cases entirely stripping the trees of their fruit."

Food. The food of the Yellow-fronted Parrakeet is the same as that of the other species, namely, seeds and soft fruits. Sometimes this parrakeet is seen feeding on the ground. The kinds of food mentioned by various observers include tutu, konini, horopito and karamu berries, and seeds of grasses, beech and silver pine (*Dacrydium intermedium*).

Nesting. The favourite nesting site of the Yellow-fronted Parrakeet is natural holes in trees, living or dead. At Maungahaumia, in the east coast district of the North Island, M'Lean found many nests in hollow living beech, hinau and kawaka trees. On Kapiti Wilkinson found a nest in a kohekohe tree in a hole under a broken branch about fifteen feet above the ground. Potts found nests between the trunk and the dissevered bark of decaying trees. The eggs are laid in a depression in the accumulation of wood refuse which collects in such places. The breeding period extends over the greater part of the year. Young birds have been noted from July and August, through the summer, until April. Bushmen in the Te Whaiti district, according to McKenzie, say that the male habit is to come to the nest, take the female away to feed her, and then escort her back to the nesting hole.

Some interesting observations on parrakeet chicks have been made by Guthrie-Smith who found three nests on the island of Ulva in Paterson Inlet. "The female bird," he writes, "I think, took entire charge of the feeding department, and I believe the supplies consisted of the tender tips of certain shrubs—coprosmas I think—and their embryo blossoms. The eggs are laid intermittently, so that after the earliest born chicks can give forth the heat necessary to hatch those eggs that remain, the hen's whole time may be devoted to feeding the brood."

References.—Kuhl, Nov. Act. Phys. Med. Acad., 10, 46, 1820 (*Psittacus auriceps,* South Il.). Buller, Birds N.Z., 61, col. pl. 1872; 2nd ed. 1, 142, col. pl. 1888. M'Lean, Ibis, 1907, p. 523, Guthrie-Smith, Mutton Birds, 15, 1914.

Chatham Island Yellow-fronted Parrakeet

Cyanoramphus auriceps forbesi

The first specimens of this subspecies to be collected were obtained by H. H. Travers who visited the Chatham Islands in 1871 for the purpose of collecting plants and birds. More than twenty years later Rothschild described it as a new species from specimens sent to him by W. Hawkins.

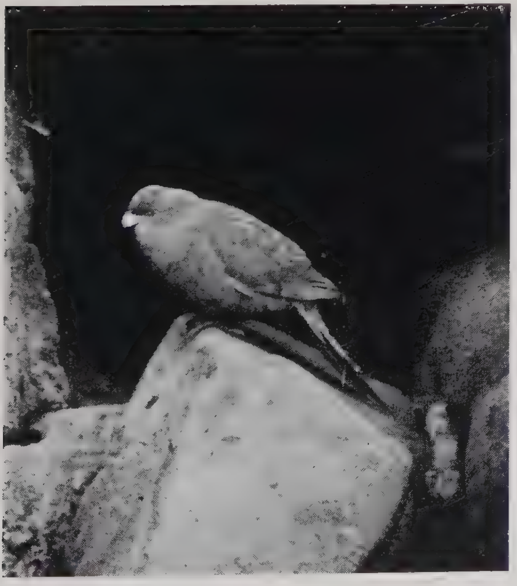
Adult. General colour similar to *C. a. auriceps* but several differences: (1) larger size, (2) the frontal crimson band does not reach the eyes, (3) the sides of the face are emerald green, (4) more yellowish on throat and breast, (5) primary coverts greenish blue, (6) outer webs of primaries green with a strip of blue near the shaft. It is a very well marked subspecies which has evidently been isolated from its New Zealand relative for a long time. Male: Bill 18-19, wing 132-134, tail 165-170, tarsus 20-21, longer fore toe 22-25 mm. Female: 14, 122, 129, 19, 26 mm.

Eggs. Broadly elliptical, white. 22.5 x 19, 24.2 x 19.2 mm.

Distribution. Chatham Islands. Formerly on Mangere, Little Mangere and Pitt Islands. Now confined to Little Mangere Island.

Habits. The only published account of the habits of the Chatham Island Yellow-fronted Parrakeet is that of C. A. Fleming who, with E. G. Turbott, succeeded in landing on Little Mangere Island, its only known habitat. The following information is taken from Fleming's paper. Formerly this subspecies inhabited both Mangere and Little Mangere and regularly visited Pitt

Island. "Since the deforestation of Mangere," writes Fleming, "*forbesi* has been confined to Little Mangere, and, although odd birds have been seen by shearers on Mangere at various times, apparently the habit of flying over to Pitt Island has been lost; the absence of trees on northern Pitt Island may account for that." Describing his visit to Little Mangere Fleming says: "After an hour's difficult climbing we reached the summit, passing successively colonies of *Stictocarbo*, Terns, and Gulls. Some distance below the top we passed through small hanging ledges of scrub and there we saw and heard our first *forbesi*. In the tangle of wind-beaten trees and vines on the summit we found the Parrakeet very plentiful, chattering, often in pairs, in the branches, feeding on the numerous seeding plants, and flying up with a flash of brilliance when we disturbed them. A hundred birds would be a very conservative estimate of the Parrakeet population of Little Mangere. . . . One well-clawed hole in a tree was apparently a nest, but it proved impossible to investigate it. From the scarcity of hollow trees on Little Mangere, it seems probable that rock crevices may be used for nesting as well. There were numbers of immature birds with short tails, with their parents. . . . Mr. R. Paynter, of Kaingaroa, tells me that in the earlier days of Pitt Island settlement Parrakeets of both species flocked to the coast at Flower Pot Harbour in the season when *Mesembryanthemum* was in flower and *Acaena* fruiting, to feed on those plants. . . . On Mangere, when it was forested, both *forbesi* and *novae-zelandiae* were present, the former, however, predominating."



Antipodes Island *R. K. Dell*

ANTIPODES ISLAND GREEN PARRAKEET

References—Rothschild, Proc. Zool. Soc., 1893, p. 529 (*Cyanorhamphus forbesi*, Chatham Islands). Fleming, Emu, 38, 502, 1939.

Orange-fronted Parrakeet

Cyanoramphus malherbi

This little parrakeet was first described by Souance in 1857 from an unknown locality. It was next found by Haast in the forests of the Oxford ranges, in 1869, and a specimen was forwarded to Buller who, not recognising it as Souance's species, described it as new. It has since been collected in several other localities.

Adult. Forehead orange; crown pale yellow; upper surface deep green; a patch of orange on each side of the rump; primary coverts and second to fifth primaries deep violet-blue on their outer webs, dark brown at tips and on inner webs; tail dark green. Under surface pale green. Bill silvery bluish, black at tip. Feet pale brown. Bill 12-14, wing 104-110, tail 112-115, tarsus 16, longer fore toe 22 mm.

Eggs. Broadly elliptic. 21.2 x 18, 21.8 x 18 mm. Mount Peel. Canterbury.

Distribution. North Island. Formerly on Hen and Little Barrier Islands. Reischek said that he shot birds of this species on both these islands in the early eighties. South Island. Throughout the forested portions but nowhere common. Formerly it was much more widespread. In 1874 it was found near Dunedin. Localities where the species has been recorded: Takaka, Owen Junction, Mount Alexander (near Lake Brunner), Oxford, Manapouri, Dusky Sound.

Habits. The Orange-fronted Parrakeet has been observed only in forest and subalpine scrub. According to Reischek it feeds on fruits and seeds. Potts said that it was fairly represented in the large flocks of parrakeets that invaded Canterbury in the summer of 1884-1885. Haast said that this species and the Yellow-fronted Parrakeet "occur always together, but in some localities the first and in others the second is predominant."

References.—Souance, Rev. Mag. Zool., 1857, p. 98 (*C. malherbi*). Buller, Ibis, 1869, p. 39 (*Platycercus alpinus*); Birds N.Z., xvi, 1872; 2nd ed., 1, 46, 1888.

Antipodes Island Green Parrakeet
Cyanoramphus unicolor

This parrakeet, the largest species of the genus, was described as far back as 1831 from a specimen that had been taken to England alive and placed in the Zoological Society's Gardens. After it died, the skin was preserved in the British Museum. The locality from which the specimen had come was not recorded so that Buller did not include the species as a New Zealand bird in the first edition of his work. In March, 1886, however, it was rediscovered by Captain Fairchild of the Government steamer *Stella,* at Antipodes Island, where it is fairly common in all parts of the lonely island.

Adult. Upper surface dark green; top of head and round the bill emerald green; wings dark green with yellowish green edges to the feathers, margins of primaries light blue, primary coverts and bastard quills indigo blue. Tail dark green with yellowish green edges to the feathers. Under surface yellowish green. Upper mandible silvery grey with black tip, lower mandible black. Iris orange. Feet brown. Male: bill 24-28, wing 150-155, tail 140-165, tarsus 23-26, longer fore toe 30-38 mm. Female: 20-23, 146, 152-163, 20-24, 29-32 mm.

Eggs. Nearly spherical, white. 25.4 x 23, 27 x 23 mm.

Distribution. Antipodes Island: common. Transferred to Kapiti Island in 1907 but has not survived.

Habits. The Antipodes Island Parrakeet is a ground bird which walks and climbs but seldom takes wing. It is found among the tussocks and scrub and also on the rocks along the shore including the breeding places of the penguins. It is quite fearless and makes a low chattering sound as it walks about. It breeds in holes in the thick matted bases of the grass tussocks.

References.—Lear, Ill. Psitt. pt. iv, 1831 (*Platycercus unicolor*). Buller, Birds N.Z., 2nd ed., 1, 148, 1888; Suppl., 2, 81, col. pl. 1905. Hector, Trans. N.Z. Inst., 27, 285, 1895.

EXTINCT BIRDS

ORDER DINORNITHIFORMES
MOAS

Large flightless birds with massive skeletons. Skull broad and flattened, bill shorter than cranium, decurved at tip which is blunt or rounded in vertical view. Wing bones absent. Feathers without barbicels, aftershaft present. No quill feathers have been discovered. Sternum raft-shaped, no keel, body more or less rectangular and turned upwards along the front border; coracoid depressions widely separated. Pelvis with broad flattened postacetabular region forming the "escutcheon"; ischia and pubes usually free. Upper end of femur concave. Hind toe present and elevated.

Moas agree with other Ratite birds in the vomer and pterygoid being in contact, the simple-headed quadrate, presence of basipterygoid processes, keelless sternum, angle of coracoid and scapular greater than a right angle and free ischia and pubes. Of the six orders of Ratite birds—ostriches, emus, elephant birds, rheas, moas and kiwis—the moas most resemble the kiwis, agreeing in a number of characters which contrast with those of the other orders.

History of Discovery

A certain amount of romance surrounds the history of the discovery of the moas in New Zealand. The first allusion to these gigantic birds is contained in the following passage by Polack: "That a species of the emu, or a bird of the genus Struthio, formerly existed in the northern island, I feel well assured as several large fossil ossifications were shewn to me when I was residing in the vicinity of the East Cape, said to have been found at the base of the inland mountain of Ikorangi. The natives added that, in times long past, they received the tradition that very large birds had existed but the scarcity of animal food, as well as the easy method of entrapping them, had caused their extermination. (*New Zealand,* vol. 1, p. 303, 1838). Later in the same work, Polack states that "Petrifications of the bones of large birds, supposed to be wholly extinct, have often been presented to me by the natives" (p. 345). Polack spent about two years, between 1834 and 1837, in the East Cape district so that his discovery cannot have been later than 1837.

During his residence in the Poverty Bay district between 1831 and 1837 Mr. J. W. Harris collected a number of Maori articles and a bone belonging to a bird which, he says, the Maoris called *A Movie.* This bone was the shaft of a femur of the species now known as *Dinornis ingens.* Harris took it to Sydney in February, 1837, and gave it to Dr. J. Rule who took it to England and showed it to Professor Richard Owen. After carefully examining the bone Owen made his famous pronouncement that "there had existed and perhaps still exists in New Zealand a race of struthious birds of larger and more colossal size than the ostrich or any known species."

This was the first moa bone to reach England and while of great historical interest no information of scientific value was obtained from it. The first important collection of moa bones was that gathered together by a missionary, the Rev. W. Williams, during the years 1841-1843. This collection was forwarded to Dr. Buckland in England and he presented it to the Royal College of Surgeons. Owen, who examined the bones, published, in 1843, in the *Proceedings of the Zoological Society,* a short paper in which he characterised the species *Dinornis novaezealandiae.* This was followed in 1844 by the first of a remarkable series of monographs on extinct birds that appeared in the *Transactions of the Zoological Society.* These were gathered together and published in 1879, in two volumes under the title of *The Extinct Wingless Birds of New Zealand.* The material at first used by Owen was obtained in large part from Mr. W. B. D. Mantell, who explored the Waikouaiti and Te Rangatapu bone deposits. Other early contributors were Percy Earl, Mackellar, Rev. Richard Taylor and W. Swainson.

The Rev. William Colenso, on his visit to the East Coast district in 1841-1842 procured from the Maoris several bones of the moa. His account of these, printed in the *Tasmanian Journal of Science,* after August, 1843, was the first paper on moas published by anyone working in New Zealand.

From the time of Williams, Taylor and Colenso until the present day there has been brought to light a long series of moa bone deposits, several of them being of first importance for elucidating the structure and habits of these remarkable birds.

No more important discovery of moa remains has been made than the swamp deposit at Pyramid Valley. In 1937 a few bones were accidentally uncovered while digging a hole to bury a horse and they were taken to a woolshed where they lay unreported for more than a year. Then the bones were taken to the Canterbury Museum and within two months, February, 1939, systematic digging was commenced. Gradually there came to light the best preserved skeletons of moas that have ever been obtained, though in many cases the skulls had been lost. With one of the skeletons was a broken egg proving the bird to be a female. The yellow resilient material in which the bones were embedded not only bogged those birds that ventured to walk into it but preserved their bones in perfect condition to this day. About 150 skeletons have already been taken from this swamp though only a small portion has been dug over.

Moa Bone Deposits

In a few localities moa bones have been found lying on the ground. Bones and gizzard stones were found on the surface in Canterbury and Otago after fire had cleared away the native grasses and shrubs in order to make way for European grasses. On the Maungaraki Range in the North Island parts of the skeleton *Dinornis giganteus* were found. They were very weather worn so possibly they had lain there since the bird had died. Moa skeletons, some almost complete, have been found on sand dunes.

Caves and potholes have produced many moa skeletons, some well preserved and almost complete. The structure of the caves in which the bones have been found indicate that in most cases the birds have died by misadventure, having fallen or slid into the cave from which they were unable to escape.

River deposits have been the means of preserving moa bones, eggs and footprints. The first discovery of moa bones, namely, that made in the East Cape district in 1837, were in river bed deposits. So also was the famous discovery at Glenmark in 1868. Footprints are preserved in the river mud by silting after the birds have walked over the surface. After a space of time which might be hundreds of years the river may scour its banks and again expose the footprints. Similarly several eggs of moas have been buried by river gravel and silt and then uncovered by the river changing its course.

Swamps have yielded the largest finds of moa bones. Throughout New Zealand moa bone swamps exhibit a uniformity of structure probably due to the changes in climate that have taken place since the glacial period. Thus the bottom deposit is fine bluish clay evidently laid down during a dry period when only fine silt found its way into the swamp hollows. This blue mud usually contains no moa bones. Then follows the main swamp deposit, black in colour and containing much vegetable matter including trunks and branches of trees. The moa bones are generally concentrated near the bottom of this deposit, which obviously accumulated during a wet period when much material, both inorganic and organic, including the bodies of birds, was carried into what was then a lake. Usually the bones found in swamps are not in the best of condition. One notable exception is the swamp in Pyramid Valley which seems to have run a different course from that of the others. The special conditions here seem to be first the fact that the swamp is near the tops of the hills and consequently without a stream of any size entering it. Secondly, the surrounding rocks are mostly limestone which dissolves in water, and thirdly the district is one of the driest in New Zealand. This combination, presumably, resulted in the production of a resilient yellow deposit of almost colloidal consistency composed of limestone 11.6, clay 3, organic matter 6.5, and water 78.9 per cent. The bones that have been taken from this swamp look quite fresh. At the base of this yellow deposit is stiff blue clay without bones.

Mud springs at Upokongaro, near the Wanganui River, are deep holes filled with liquid mud and covered with floating swamp vegetation. The depth to which a pole can easily be pushed varies from a few feet to over twenty feet. A moa venturing into such a swamp would quickly be bogged and the more it struggled the deeper it would sink and so today we find the bones at the bottom of the mud springs.

Origin and Evolution of the Moas

Moas belong to the group of birds known as Ratites, so named because of their keelless or raft-like sternum. Six orders comprise this group, namely: moas, kiwis, rheas, ostriches, emus and cassowaries, elephant birds. These orders differ from each other about as much as any one of them differs from the Carinate birds, or those with a keeled sternum. The orders of Ratite birds are, with the exception of the ostriches, restricted to different regions, in some cases continents, in others islands, as Madagascar and New Zealand. The ostriches are or were widely distributed over Africa, Europe and Asia. It would seem, therefore, that each of these orders evolved in regions completely or almost completely separated from one another, and that this state of isolation must have been maintained for a very long time in order to account for the considerable differences in structure between the several orders and the multiplication of species in each region. The kiwis pursued a very different line of development from their geographic partners the moas, though in their general characters they resemble the moas more closely than they do any other group of birds. There is evidence, in the finding of a portion of a femur in Queensland, to show that the range of the moas at one time extended as far north-west of New Zealand as the continent of Australia. It follows, therefore, probably, that they originated in the Australo-New Zealand region as a distinct group of Ratite birds and later became isolated in the New Zealand area where their evolution into at least 28 species took place. These species can be grouped in two families and seven genera, showing a considerable degree of differentiation, though as a whole the moas form a single well-defined natural group. Apparently, in their isolation in New Zealand, they had no enemies, and so their evolution proceeded at a steady rate and resulted in a graded series of species with a marked break between the members of the genus *Dinornis* and the remainder of the moas.

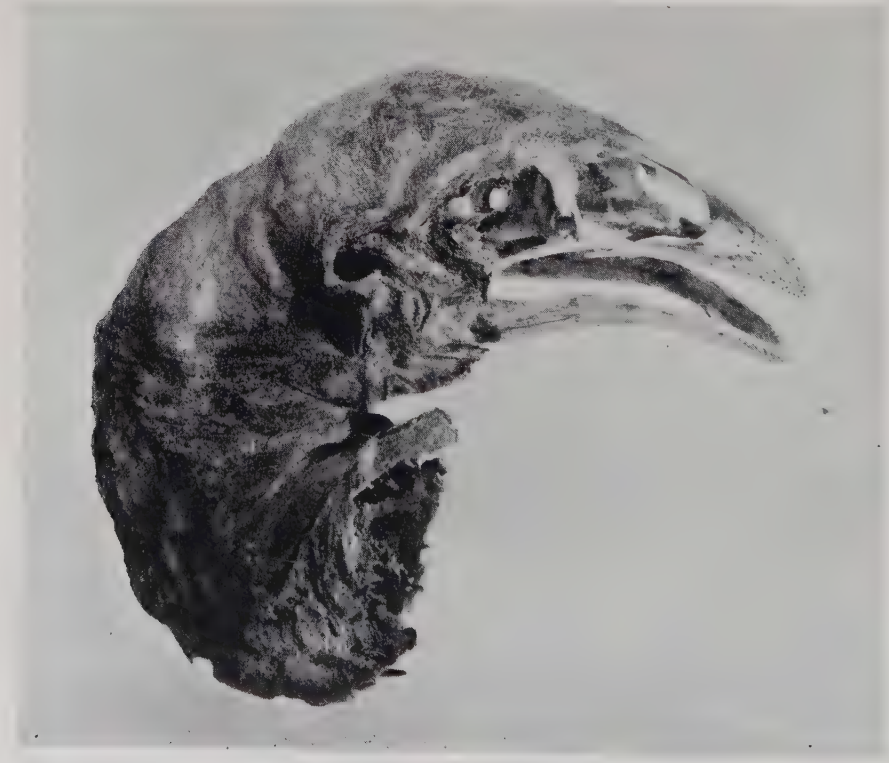
No doubt when the New Zealand area was of continental dimensions the species would better be able to keep separate, this being one of the conditions of evolving into different forms. With the contraction of the land all would be herded together as their remains are now found. Cook Strait became a barrier in rather recent geological times. Two genera, *Emeus* and *Megalapteryx,* have their northern limit at Cook Strait. There are nine species confined to the North Island and 12 to the South Island. Six species are common to both islands.

While the moas were evolving and multiplying their species certain changes in some of the organs, due to disuse, were taking place. The wings were completely lost, a unique feature among birds, and the scapula and coracoid which should support wings were reduced and fused into a single rod-like bone. In some of the large species, obviously sluggish birds, the limb bones became very robust with prominent ridges for the attachment of the muscles. In *Dinornis* the leg bones became slender and long and no doubt the members of this genus were the swiftest of the moas.

Extinction of the Moa

The extinction of the moas may have been brought about by natural agencies or by the Maori who hunted them for food. It is difficult to imagine what natural phenomena could have exterminated so many species of large birds within a short space of time. The advent of an ice age might, if means of escape were cut off, have effected their destruction, but the period when glaciers were at their greatest extent in New Zealand was long antecedent to the date of the extinction of the moas. Many moa bones have been found in swamps and there are reasons for believing that the moa sought much of its food in swamps and got bogged while so doing. None of the moas which got bogged in the Pyramid Valley swamp could have been washed in by rivers.

Most South Island swamps containing moa bones are built up in the same order, namely,



Cromwell *Dominion Museum*

MEGALAPTERYX DIDINUS

a bottom layer of fine bluish mud without moa bones, overlaid by an accumulation of black earth containing tree trunks and other plant remains and moa bones. Above this is recent soil without bones. The fine blue mud indicates that at first the climate was rather dry. Following this was a wet period with much material washed into the swamp bringing with it the bodies of moas. Finally came the present drier conditions but by this time the moas had become extinct. These climatic changes correspond in a general way with those derived from the study of peat bogs and may be taken as a guide to the changes in climate from the close of the glacial age to the present day. The bulk of the remains of moas that have been recovered from swamps thus seem to have been brought in during the rainy period of the order of fifteen to five thousand years before the present time. The geological evidence thus tells us that there were very heavy casualties among the moas during the pluvial period following the glacial age.

That the moa survived until comparatively recent times is proved by the discovery of remains with the dried skin and muscles still attached, and the fact that several complete eggs and many feathers have also been found. Two dried heads have come to light, both from caves in Otago. They show the eyes, tongue, larynx, windpipe, ear opening and skin. It is, however, hazardous to judge age by appearance because the state of preservation depends on the amount of moisture and plant remains present. Most swamp bones are badly preserved. At Pyramid Valley the conditions were such that what vegetation was present did not go black and promote decomposition of the bones.

Although large numbers of moas died from natural causes during the post-glacial rainy period we do not know that any species became extinct at that time. The final disappearance of the moas came after the invasion of the land by the Maoris from eastern Polynesia.

The evidence that the moas not only existed when the Maoris arrived in New Zealand but were hunted and eaten by them is based on the fact that in several places the remains of moas in considerable quantities have been found associated with old Maori camps. The Maori ovens unearthed at Waingongoro in the North Island and Shag River in the South Island afford indisputable evidence that the moa was used by the Maori for food.

Maori burial sites in the eastern side of the South Island have been the subject of investigation by R. S. Duff, who describes particularly Maori burials near the mouth of the Wairau River. In these were found moa eggs with a hole bored at one end. Evidently they were for holding water for the long journey which the dead would have to make. Portions of moa bones and articles made of moa bone were included in the graves.

Another line of evidence confirming that relating to Maori camping sites is furnished by the references to the moa in Maori traditions. Downes points out that the moa is alluded to under different names and hence it has sometimes escaped notice. Judge Maning, who knew the Maoris intimately, states that the moas existed in great numbers when the Maoris first arrived in New Zealand and that the Maoris hunted and eventually exterminated them. Various details of the birds themselves and of the method of hunting them are given in the writings of John White, while in the *Journal of the Polynesian Society* there is a circumstantial account of moas being seen inland from Maketu. The traditions of the Murihiku folk as collected by Beattie include several references to the moa. Among other things it is stated that they were killed out by the Waitaha people before the arrival of the great Maori migration of 1350 A.D. Beattie's informants state also that the moa was roasted on a fire made of koromiko wood and that the feathers were prized for making cloaks.

It is clear that the moas did not become extinct until after the arrival of the Maoris in New Zealand in considerable numbers, that is, after the year 1350. Moas may have survived in the South Island to within 200 or 300 years of the present time. Almost certainly they became extinct in the North Island before they did in the South Island.

What has been said above indicates that the final extinction of the moas was due to the Maori. Apparently, however, the moa population was considerably reduced by climatic conditions and perhaps shortage of food before the arrival of the Maori.

HABITS OF THE MOA

Several rather circumstantial accounts of the habits of the moa have been handed down in Maori traditions. As they agree for the most part, and, moreover, are what might be expected from analogy with living species of Ratite birds, the following summary is of interest. The moa was said to be able to run with great speed and to defend itself by kicking. Both dogs and men were reported to have been killed by a kick from a moa. It was mainly a vegetable feeder, living on fern root, soft leaves and grass and also on fruits. It was also said to eat fresh-water mussels, crayfish and fish, though this seems unlikely. It lived in the open country, frequenting especially the sides of streams and lakes but it entered the forest for the sake of feeding on fruits. In bad weather it resorted to caves and hollow trees. The only references to the breeding habits of the moa stated that while the hen bird incubated the eggs, which took two moons, the male supplied her with food.

Footprints found on the banks of rivers confirm the Maori tradition that moas frequented the sides of rivers. In several swamps leg bones in an upright position have been found showing that the birds waded in and became bogged. Stomach contents from the Pyramid Valley swamp include seeds of matai, ngaio, karamu, kamahi and carex, and leaves of *Rapanea divaricata.*

Scattered over the surface in certain parts of New Zealand are sometimes to be found small heaps of rounded quartz stones. Where they are found in places such as a swamp, composed otherwise of peaty matter, it may safely be concluded that they are the gizzard-stones of moas. They vary in size from those smaller than a pea to those larger than a pigeon's egg. In one lot, the stones weighed six pounds seven ounces. In several instances gizzard-stones have been found with the remains of moas' skeletons. Single stones weighing two ounces were included in some of the heaps and usually all were of white quartz.

SKELETON OF MOAS

Skull. The upper surface of the cranium is broad and flattened. It is widest behind the orbits. The premaxillary, which forms the tip of the beak, is decurved. It has a prominent septum and the base is variously expanded in front with horizontal maxillary processes forming the anterior part of the palate. The temporal fossae spread over the cranium, least in *Emeus* and *Euryapteryx,* most in *Anomalopteryx* in which the posterior border meets the lamboidal ridge. The preorbital plate, which divides the orbit from the nasal chamber, is composed of the lacrymal, alinasal, antorbital and another part of the ectethmoid. The lacrymal is a vertical column with the inner side produced below the outer and curving forwards at the tip to form the lacrymal foramen, closed only in old birds. In all genera except *Euryapteryx* and *Zelornis* the expanded forward ends of the maxillae have each an antrim opening backwards. The basiphenoidal rostrum is fused with the mesethmoid which bears a triangular horizontal plate on each side articulating with the maxilla.

Vertebrae. The normal number is 56 namely, cervical 21, thoracic 6, pelvic 18 caudal 11.

Ribs. The prevalent number is nine pairs. *Megalapteryx* has only eight pairs. The first three are free, the fourth and fifth articulate with the sternal ribs and bear uncinate processes. The sixth or last thoracic rib usually is free. The first pelvic rib is free, the second and third fused with the pelvis. In *Megalapteryx* there are two pelvic ribs, the first free, the second fixed.

Sternum. The moa sternum has a more or less rectangular raft-like body with a long straight upturned anterior margin which separates widely the coracoid depressions. Posteriorly there is a wide, sometimes bifurcate, xiphoid process and two diverging lateral processes.

Scapula and *coracoid.* These two bones are fused into a single rod bent and expanded at the junction of the two elements. The articular surface for the sternum is rudimentary and there is no glenoid cavity showing that the wing bones had completely disappeared.

Pelvis. The pelvis is a strong broad bone. In front the ilia are concave nearly vertical plates. Behind the acetabulum they expand horizontally and, together with the postacetabular vertebrae form a broad ovate platform, the "escutcheon." The ischia and pubes usually end freely but in old birds their ends may expand and fuse.

Leg bones. In all cases these are strong and thus suitable for supporting the heavy body which the moa possessed. They are especially heavy in the large species of *Pachyornis* and *Euryapteryx.* In *Dinornis* they are long and slender. The upper end of the femur is concave as in *Aepyornis.* In *Megalapteryx* the shaft is curved as in the kiwi. In the tibia the lower end is expanded on the inner side and there is a broad trochlear bridge. The tibia of the moa resembles that of *Apteryx* more than that of any other genus of Ratite birds. The shaft of the metatarsus is flattened in front and behind.

Toe bones. Except in *Emeus* and *Euryapteryx* (and possibly in *Zelornis*), the number of phalanges is the same as in the vast majority of birds, namely, including the unguis, three on the first digit, three on the second, four on the third and five on the fourth. In *Emeus* and *Eurapteryx* it is known that there are only four phalanges on the fourth digit. The first digit is smaller than the others and is attached to the metatarsus one third its length from the lower end.

Moa Eggs

Nineteen eggs of moas sufficiently complete for measuring one or both diameters have been found. Of these six were from river deposits, one from a swamp, three from sand dunes and nine from Maori camp sites. According to size, shape and surface markings there are seven types and presumably they represent as many different species

MOA EGGS

The figure in parentheses in the column "Size" is the proportion of the breadth to the length = 100.

Species	Locality	Collector	Date	Size	Condition	Museum
Pachyornis elephantopus?	Ettrick	C. Gibson	1911	200 x 138 (69)	Perfect	Otago
Pachyornis elephantopus?	Wairau	J. Eyles	1939	194 x 139 (71)	Perfect	Dominion
Emeus crassus	Pyramid Valley	R. A. Falla	1939	179 x 134 (75)	Restored	Cant'b'y
Euryapteryx curtus?	Doubtless Bay	Matthews	1900	120 x 91 (76)	Perfect	Auckland
E. gravis?	Wairau	J. Eyles	1942	205 x 158 (77)	Restored	Cant'b'y
Anomalopteryx didiformis?	Kaiiwi	A. Clutterbuck	1931	159 x 114 (72)	Perfect	Wanganui
Anomalopteryx didiformis?	Tukituki River	J. Jorgensen	1936	152 x 121 (79)	Restored	Hawke's Bay
Dinornis robustus?	Shag River	G. Griffiths	1941	221 x 150 (68)	Perfect	Otago
D. maximus?	Kaikoura	Fyffe	1859	253 x 178 (70.5)	Perfect	

Wairau Bar *Dominion Museum*

EGG OF PACHYORNIS ELEPHANTOPUS (?)

of moas. In only one case can the species be definitely identified and that is the egg found in the Pyramid Valley swamp in association with a skeleton of *Emeus crassus*. This egg provides a clue as to the relationship between the size of the egg and the leg bones. The names tentatively suggested in the list on page 571 are based solely on this relationship.

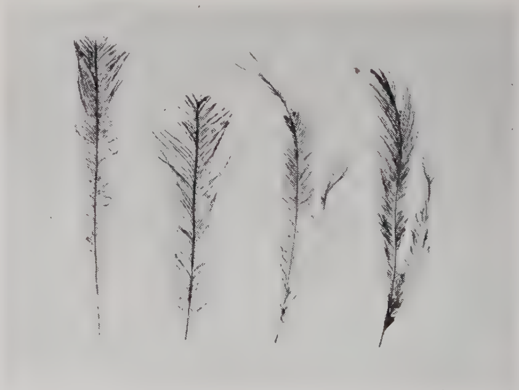
Some broken moa egg-shells found near Lake Wakatipu were of a pale green colour. The microscopic structure was examined by Hutton, who described an outer layer of thin lamina parallel to the surface and an inner layer of columns at right angles to the surface, each column containing triangular prisms of carbonate of lime. This structure agrees with that found in the egg-shell of a rhea. The chemical composition of moa egg-shell, as found by Liversidge, was very similar to that of recent egg-shells, showing that it had undergone only a very slight change. The principal constituents were calcium carbonate 91, calcium phosphate 1.3, lime 2, organic matter 4.9 parts in every hundred.

Moa Feathers

The evidence of some moa remains (*Megalapteryx didinus*) with skin attached found in a cave at Queenstown, indicates that the moas were clothed in a fairly uniform covering of feathers from head to foot, right down to the toes. In this specimen the feather pits in the skin showed that the head was covered with quite small feathers. In some skulls, however, the outer surface of the cranium shows large pits and these are supposed to indicate that some species of moas were possessed of crests. A Maori tradition, quoted by Dr. G. A. Mantell, states that the head and tail of moas were adorned with plumes of feathers which were worn by chiefs as ornaments of distinction. In their structure, moa feathers resemble closely those of the emu. There is a large accessory plume, the barbs are furnished with barbules right to their tips, but there are no barbicels. Some moa feathers found in the bed of the Molyneux River, buried deeply in the sediment, appeared quite fresh on being extracted. They were examined shortly afterwards by Hutton, who described them as brown or reddish brown for the basal two-thirds, then black and with a white tip. Other feathers examined by Taylor White had a yellow central stripe bordered with purplish brown, while a large one was pure white. Moa feathers measure up to seven inches in length and one to one and a half in breadth.

Classification of the Moa

Several schemes for the classification of the moas have been proposed. Professor Owen, who described the first species, was content to refer all to the genus Dinornis,



Waikaia River, Old Man Range

Dominion Museum

FEATHERS OF MEGALAPTERYX DIDINUS

but Reichenbach, as early as 1852, proposed a generic name for each of the species then known to him. The first serious attempt to classify the moas was that of Haast, in 1874, who admitted ten species which he grouped in four genera. Lydekker, in 1891, acknowledged 23 species distributed among five genera. In the present work the scheme that I adopted in 1949 is used. It distributed the 28 species recognized among seven genera included in two families. One of the species is known only from a few fragments of semi-fossil bones. In addition to the New Zealand species of moas there is an Australian one, *Pachyornis queenslandiae,* based on the head of a femur found in Queensland.

The definitions of the families and genera of moas are based mainly on the skull. By carefully following and comparing the descriptions and keys given under these headings it should not be difficult to identify the species especially if the skull, pelvis, sternum and leg bones are available.

FAMILY ANOMALOPTERYGIDAE

Bill not flattened nor depressed at the tip. It may be narrow or broad and at most is very slightly decurved at the tip. Preorbital plate arising directly from the basiphenoidal rostrum. The sternum, except in *Pachyornis,* is narrow with the lateral processes little diverging. In *Pachyornis* the sternum is broad with the lateral processes widely diverging but it differs from the wide sternum of *Dinornis* in the lateral processes being straight. The neural spine on the nape vertebrae is double. The shaft of the tibia tapers towards the bottom.

The genera of Anomalopterygidae may be grouped in two subfamilies, Emeinae and Anomalopteryginae.

Subfamily Emeinae

Width of skull at postorbital processes greater than at zygomatic process. Temporal fossae narrow and not conspicuously spreading over the cranium. Escutcheon of pelvis rather long and gradually narrowing in front, not sloping steeply behind the acetabular crest.

Key to Genera

Bill pointed. Sternum with lateral processes widely diverging. Maxillary antrum open .... *Pachyornis*
Bill rounded. Sternum with lateral processes narrowly diverging.
  Bill narrow. Escutcheon without lateral angles. Maxillary antrum open .... *Emeus*
  Bill wide. Escutcheon angled in front. Maxillary antrum closed.
    Premaxilla not steep, peduncle of nasal process flat .... *Euryapteryx*
    Premaxilla steep, peduncle of nasal process rounded .... *Zelornis*

GENUS PACHYORNIS

Bill sharp pointed; culmen low except in *P. murihiku* in which it is noticeably higher than in any other species of moa. Space between the temporal and lambdoidal ridges usually wide. Temporal fossae moderately wide. Lower end of lacrymal not ending in a hook-like process. It does not extend so far down as in the other genera of moas nor fuse completely with the lower anterior angle of the antorbital. Sides of premaxillary septum depressed and smooth. Maxillary antrum open behind.

Sternum wide with short body, xiphoid process short and wide, lateral processes widely diverging, straight. Except in *P. murihiku* the front border turns up at right angles to the body, and within is an irregular row of perforations. In *P. murihiku* the angle of the front border to the body is greater than a right angle.

Pachyornis is near to *Emeus* differing in the sharp-pointed bill, in the primitive lacrymal-antorbital junction, in the widely diverging sternum, and in the angled pelvis. Besides the five New Zealand species there was one in Australia, *P. queenslandiae,* which differed somewhat from all the New Zealand species in the shape of the upper end of the femur, the only bone known. In my judgment *Pachyornis* is the most primitive genus of moas.

Key to Species (Lengths in cm.)

	Skull	Pelvis	Femur	Tibia	Metatarsus
P. septentrionalis	11	23-27	14-19	29-32	13-14
P. mappini	12	32-33	19-22	34-41	16-17
P. murihiku	13	36	25	43	18.5
P. australis	14-15	39			
P. elephantopus	16-18	52-53	30-33	48-60	21-27

References.—Lydekker, Cat. Foss, Birds Br. Mus., 316, 1891 (*Pachyornis,* type *Dinornis elephantopus* Owen). Archey, The Moa, 35, 1941. Oliver, Moas N.Z. Austr., 58, 1949.

Pachyornis septentrionalis

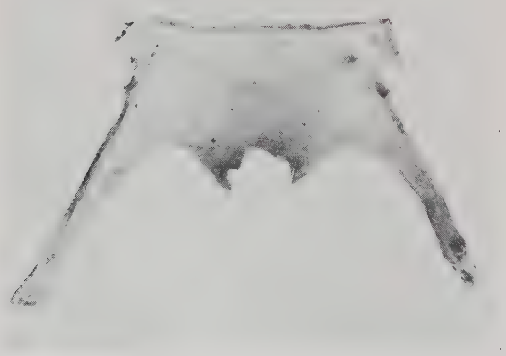
A small species of which the type specimen is an imperfect skeleton in the Dominion Museum collected by H. Hill at Pohue, Hawke's Bay. A nearly complete skeleton was later found at Waikaremoana by G. Archey and is now in the Auckland Museum.

Premaxilla sharp pointed. Lower end of lacrymal separated from the antorbital by a chink. Triangular processes thin and placed high on the rostrum. Sternum with a short body and short xiphoid process but long widely diverging lateral processes.

Skeleton from Waikaremoana: skull, length 110, width 61; sternum, width at precostals 126; pelvis, length 253, width 122; femur, length 162, tibia 273, metatarsus 127 mm.

Distribution. North Island: Doubtless Bay, Whangarei, Bay of Plenty, Waikaremoana, Pohue, Te Aute, Martinborough.

Reference.—Oliver, Moas N.Z. Austr., 61, 1949 (*P. septentrionalis,* Pohue).



Waikaremoana *Auckland Museum*

STERNUM OF PACHYORNIS SEPTENTRIONALIS

Pachyornis mappini

A larger species than *P. septentrionalis.* The type skeleton was collected by G. Archey at Mangaotaki in the Kawhia district and is preserved in the Auckland Museum. The sternum is short but differs from that of *P. septentrionalis* in the broad xiphoid process and short lateral processes.

Skeleton, type, from Mangaotaki: skull, length 120, width 68; sternum, width at precostals 145; pelvis, length 319, width 159; femur, length 203, tibia 336, metatarsus 156 mm.

Distribution. North Island but rare north of Auckland: Waipu, Amodeo Bay, Mangaotaki, Karamu, Gisborne, Mangaone, Nuhaka, Te Aute, Coonoor, Martinborough, Makirikiri. Semi-fossilized bones of this species, of Pliocene age, have been found at Eketahuna and Martinborough.

References.—Archey, The Moa, 41, 1941 (*P. mappini,* Mangaotaki). Archey, Trans. N.Z. Inst., 58, 151, 1927 (*Cela geranoides*). Oliver, Moas N.Z. Austr., 65, 1949.

Pachyornis murihiku

The only skeleton known, type of the species, was discovered by Mr. Black at Greenhills near Bluff and is preserved in the Southland Museum.

This species differs in several important points from all other members of the genus. The beak is very high and the postorbital process wide. The front margin of the sternum is rather thin and is turned up at less than a right angle from the plane of the body, which is short with wide xiphoid process and short widely diverging lateral processes. The ischia and pubes diverge from the pelvis at a wide angle.

Skeleton, type, from Greenhills: skull, length 130, width 82; sternum, width at precostals 160; pelvis, length 357, width 194; femur, length 248, tibia 426, metatarsus 185 mm.

References.—Oliver, Moas N.Z. Austr., 67, 1949 (*Pachyornis* (*Pounamua*) *murihiku*, Greenhills).

Pachyornis australis

A perfect skull with neck vertebrae was found by A. McKay in 1879 in a cave on the Salisbury Tableland at the headwaters of the Takaka River. It is preserved in the Dominion Museum. Skulls have been found in Southland, and sterna, pelves and leg bones, presumably of this species, are known from other South Island localities.

In profile the skull of this species resembles that of *P. septentrionalis*, and thus is considerably different from that of *P. murihiku* and *P. elephantopus*. The temporal fossae are narrower than is usual in *P. elephantopus*. There is a wide space between the temporal and lamboidal ridges. The triangular process is very low. The lacrymal and antorbital are not entirely fused. On the front part of the cranium are a number of shallow pits which indicate, probably, that this species had a crest.

Skull, type, from Salisbury Tableland, length 144, width 89.5; sternum, Southland, width at precostals 165; pelvis, Nelson, length 387, width 194 mm.

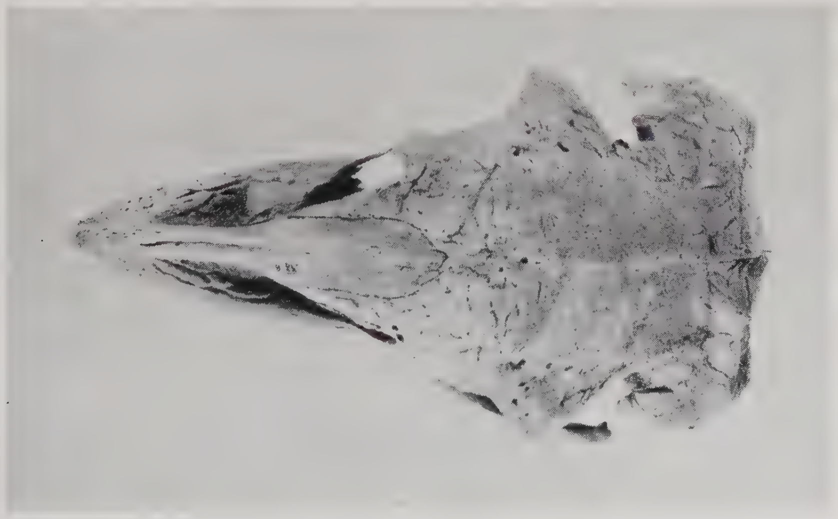
References.—Oliver, Moas N.Z. Austr., 70, 1949 (*Pachyornis australis*, Salisbury Tableland). Parker, Trans. Zool. Soc., 13, 378, pl. lx, 1895.

Pachyornis elephantopus

This massive species was discovered by W. B. D. Mantell at Awamoa, near Oamaru, and the bones were taken by him to England in 1856. A skeleton was built up of bones of several individual birds and placed on view in the British Museum. This was described by Richard Owen as *Dinornis elephantopus*. A skeleton, complete except for the skull and a few other bones, was found in the Waitaki Valley by J. Stevenson about 1870. It is now preserved in the Otago Museum. This species was killed by the Maoris for food and to provide bone for the manufacture of implements and ornaments. Eggs, with a hole drilled at one end, and found buried with Maori skeletons, at Wairau Mouth, possibly belong to this species.

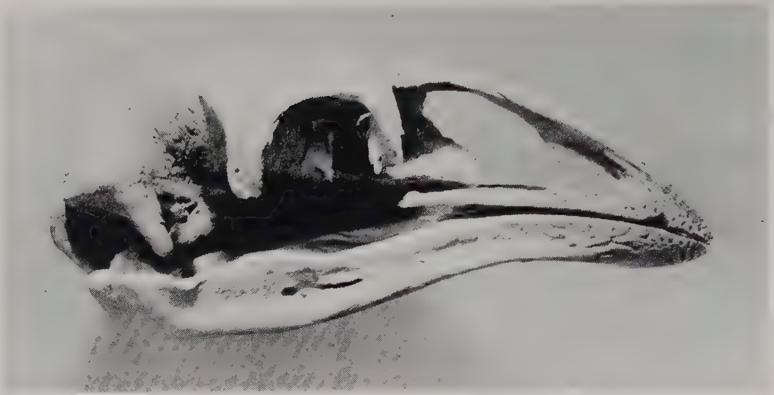
Differing from all the other species of the genus, *Pachyornis elephantopus* has a long beak giving the skull a distinctive appearance. The large sternum has a wide xiphoid process and short, broad, widely diverging lateral processes. The pelvis has prominent ridges on the front of the escutcheon. Particularly characteristic of the species are the broad and massive leg bones with expanded ends and large articular surfaces.

Skeleton from Pyramid Valley: Skull,



Pyramid Valley *Canterbury Museum*

SKULL OF PACHYORNIS ELEPHANTOPUS



Pyramid Valley *Canterbury Museum*

SKULL OF PACHYORNIS ELEPHANTOPUS

length 173, width 89; sternum, width at precostals 222; pelvis, length 530, width 280; femur, length 320, tibia 566, metatarsus 231 mm.

Distribution. South Island: Tarakohe, Takaka Hill, Broken River, Glenmark, Pyramid Valley, Awamoa, Enfield, Herbert, Waitaki River, Hamilton Swamp, Shag River, Papatowai.

References.—Owen, Proc. Zool. Soc., 1856, 54 (*Dinornis elephantopus,* Awamoa). Owen, Trans. Zool. Soc., 4, 149, 1858. Archey, The Moa, 36, 1941. Falla, Rec. Cant. Mus., 4 346, 1941. Oliver, Moas N.Z. Austr., 74, 1949.

Genus Emeus

Bill evenly rounded at the tip, rather sharply pointed in profile. Temporal and lambdoidal ridges separated by a wide space. Each exoccipital with a perforated depression with radiating channels. Lower end of lachrymal with a hook-like process. Maxillary antrum open behind.

Sternum with a square body, long xiphoid process and long little diverging lateral processes. Pelvis with regularly curving sides to the escutcheon. Outer toe with four phalanges.

Emeus is related to *Pachyornis* on the one side and to *Euryapteryx* on the other. The beak is intermediate in outline, being broader than in *Pachyornis* and narrower than in *Euryapteryx.* Compared with *Pachyornis* the lachymal has extended downwards, but not so much as it has in *Euryapteryx.* Only *Emeus* and *Euryapteryx* are known to have four phalanges on the outer toe.

Key to Species (Lengths in cm.)

	Skull	Pelvis	Femur	Tibia	Metatarsus
E. huttoni ...	10-13	34-37	22-26	34-41	16-20
E. crassus ...	13-14	38-44	26-30	43-47	20-23

References.—Reichenbach, Syst. Vog., p. XXX, 1852 (*Emeus,* type *Dinornis crassus* Owen; *Syornis,* type *D. casuarinus* Owen). Archey, The Moa, 45, 1941. Oliver, Moas N.Z. Austr., 88, 1949.

Emeus huttoni

Professor Owen first described *Emeus huttoni* from bones collected by F. W. Hutton in Hamilton Swamp, Otago. In 1870 B. S. Booth was informed by workmen of the presence of moa bones in the swamp but waited for three years, until the mining company that included it in its claim abandoned the area, before making public the discovery.

Skeleton from Wakapatu: skull, length 100, width 62; sternum, width at precostals 131; pelvis, length 350, width 185; femur, length 224, tibia 358, metatarsus 163 mm.

Distribution. Canterbury and Otago, not common: Broken River, Pyramid Valley, Waireka, Glenmark, Kapua, Enfield, Hamilton Swamp, Castle Rock, Waikouaiti, Papatowai in Maori camp site, Waipapa, Wakapatu.

References.—Owen, Ext. Birds N.Z., 430, 1879 (*Dinornis huttonii,* Hamilton Swamp). Oliver, N.Z. Birds, 49, 1930. Benham, Trans. Roy. Soc. N.Z., 64, 87, 1934 Archey, The Moa, 52, 1941. Oliver, Moas N.Z. Austr., 93, 1949.

Emeus crassus

This species was founded on a metatarsus included in Percy Earl's collection of moa bones made at Waikouaiti about 1842. It has been taken in Maori camp sites at Waitaki, Moa Bone Point, Shag Valley and Papatowai. A portion of a neck of this species including dried muscles and skin was found at Earnscleugh Cave. At Pyramid Valley many excellently preserved skeletons and a crushed egg were obtained. This is the only egg that can definitely be associated with a species of moa.

Skeleton from Pyramid Valley: Skull, length 136, width 78; sternum, width at precostals 198; pelvis, length 444, width 229; femur, length 290, tibia 467, metatarsus 227 mm.

Distribution. Canterbury and Otago, fairly common: Glenmark, Pyramid Valley, Kapua, Waitaki, Enfield, Hamilton Swamp, Shag River, Waikouaiti, Earnscleugh Cave, Ohai, Papatowai, Greenhills, Riverton, Wakapatu.

References.—Owen. Proc. Zool. Soc., 1846, 46 (*Dinornis crassus,* Waikouaiti); p. 47 (*D. casuarinus,* Waikouaiti). Oliver, N.Z. Birds, 48, 1930 (*E. crassus, casuarinus*). Archey, The Moa, 46, 1941. Falla, Rec. Cant Mus., 3, 347, 1941. Oliver, Moas N.Z. Austr., 95, 1949.

GENUS EURYAPTERYX

Beak broad and rounded. Culmen rising steeply from the tip. Temporal and lambdoidal ridges separated by a wide space. Temporal fossae rather narrow but widening above. Lower end of lacrymal hooklike. Maxillae without antrum cavity. Mandible narrowly U-shaped with diverging rami.

Sternum flattened with the front not turning up very much. There are only shallow depressions and few perforations. Xiphoid process notched at the end. Upper profile of ilia conspicuously arched. Outer toe with four phalanges.

Euryapteryx differs from *Emeus* in the wider bill and absence of an antrum in the maxilla. It is very like *Zelornis,* the only constant difference being in the premaxilla and mandible. Compared with *Zelornis, Eurapteryx* has a lower, narrower and less blunt premaxilla and a narrower and more V-shaped mandible.

Key to Species (Lengths in cm.)

	Skull	Pelvis	Femur	Tibia	Metatarsus
E. curtus ...	10	24	19	25-31	11-14
E. tane	11	30	18-20	32-34	14-16
E. geranoides	12		23-25	40-42	16-19
E. gravis	13-14	36-45	27-30	44-50	20-23

References.—Haast, Trans. N.Z. Inst., 6, 427, 1874 (*Euryapteryx,* type *Dinornis gravis* Owen). Archey, The Moa, 53, 1941. Oliver, Moas N.Z. Austr., 101, 1949.

Euryapteryx curtus

This species was described by Owen in 1846, based on a tibia collected in the East Coast district of the North Island. Two eggs found at Doubtless Bay in 1900 are tentatively referred to this species.

Skeleton from Doubtless Bay: Skull, length 102, width 63; pelvis, length 240, width 121 mm. Leg bones, Doubtless Bay, femur, length 194, tibia 254, metatarsus 111 mm.

Distribution. North Island, apparently common throughout, Lake Ohia, Doubtless Bay, Waipu, Clevedon, Poverty Bay, Te Aute, Makirikiri.

References.—Owen, Proc. Zool. Soc., 1846, 48 (*Dinornis curtus,* North Island). Archey, The Moa, 60, 1941. Oliver, Moas N.Z. Austr., 104, 1949.

Euryapteryx tane

An excellently preserved skeleton, found at Doubtless Bay and now in the Auckland Museum, is the type of this species. It is similar to *E. curtus* but larger. These two small species resemble *Emeus* more than do the larger species.

Skeleton from Doubtless Bay: Skull, length 107, width 62.5; sternum, width at precostals 138; pelvis, length 300, width 157; femur, length 197, tibia 337, metatarsus 148 mm.

Distribution. North Island, apparently common throughout: Waipu, Doubtless Bay, Lake Ohia, Clevedon, Waiotapu, Te Aute, Te Rangatapu, Waikupa (fossilized), Makirikiri.

References.—Oliver, Moas N.Z. Austr., 105, 1949 (*E. tane,* Doubtless Bay).

Euryapteryx geranoides

No complete individual skeleton of this species has so far been found. Owen, in 1848, gave the name *Palapteryx geranoides* to a skull from Te Rangatapu, Taranaki, but it has since been shown that the mandible did not belong to the same species as the other parts of the skull. *E. geranoides* is intermediate in size between *E. tane* and *E. gravis.* To it is referred an imperfect skeleton from Seatoun. These bones are very similar in shape and stoutness to those of *Euryapteryx gravis.*

Skull, Rangatapu, length, 115, width 65; leg bones, Seatoun, femur, length 242, tibia 409, metatarsus 185 mm.

Distribution. North Island: Tom Bowling Bay, Doubtless Bay, Te Aute, Te Rangatapu, Oakanga River, Coonoor, Martinborough, Seatoun. South Island: Takaka, Broken River, Herbert, Papatowai.

References.—Owen, Trans. Zool. Soc., 3, 361, 1848 (*Palapteryx geranoides,* Te Rangatapu). Archey, The Moa, 57, 1941. Oliver, Moas N.Z. Austr., 106, 1949.

Euryapteryx gravis

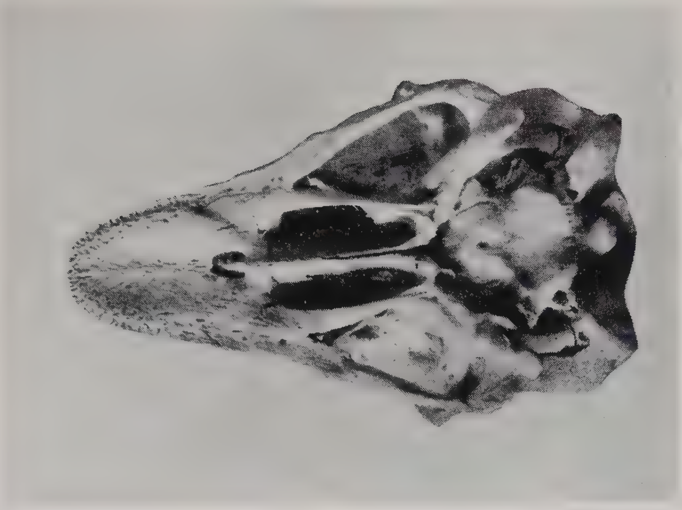
Owen described this species in 1870 from a skeleton collected at Kakanui, Otago. It has since been found in many localities in the South Island and in a few places in the North Island. Skeletons of quite fresh appearance have been taken from Pyramid Valley Swamp.

The skulls of this species can be grouped in two sizes. In the smaller size the average length of the skull is about 130 mm. and the mandible 112 mm. To this size belong the types of *E. gravis, E. boothi,* and *E. kuranui.* The larger skulls have an average length of 143 mm. with the mandible 130 mm. Skulls of this size have been obtained at Pyramid Valley and Earnscleugh Cave.

Skeleton from Pyramid Valley: Skull, length 143, width 77; sternum, width at precostals 209; pelvis, length 449, width 229; femur, length 296, tibia 502, metatarsus 233

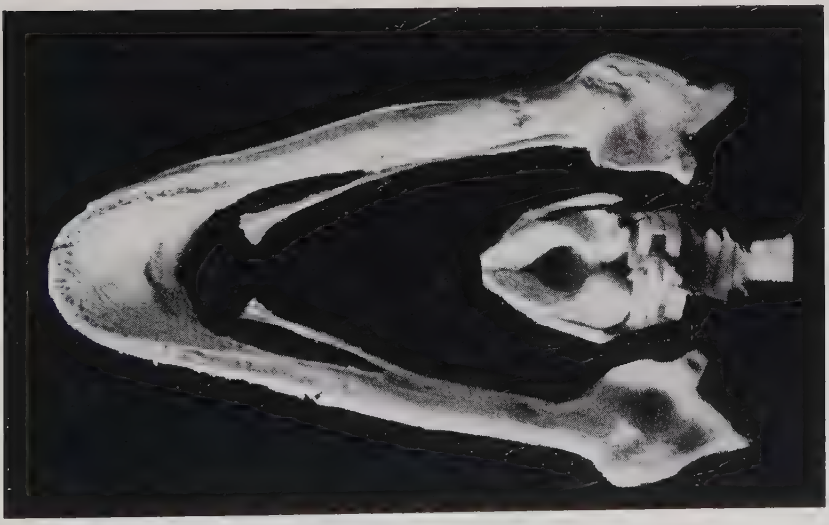
Seatoun *Dominion Museum*

LEG BONES OF EURYAPTERYX GERANOIDES



Shag Point *Otago Museum*

PALATE OF EURYAPTERYX GRAVIS



Shag Point *Otago Museum*

MANDIBLE AND LARNYX OF EURYAPTERYX GRAVIS mm. Skull of *E. kuranui,* length 133, width 81 mm.

Distribution. North Island: Te Aute, Castlepoint, Portland Island, also Hunterville and Nga Rata in beds of Pliocene age. South Island: Pyramid Valley, Kakanui, Herbert, Shag Valley, Earnscleugh Cave, Wakapatu, all based on skulls. Leg bones have been obtained from many localities in the South Island and from Stewart Island.

References.—Owen, Trans. Zool. Soc., 7, 141, 1870 (*Dinornis gravis,* Kakanui). Oliver, N.Z. Birds, 52, 1930 (*Euryapteryx kuranui,* Castlepoint). Archey, The Moa, 54, 1941. Falla, Rec. Cant. Mus., 4, 351, 1941. Oliver, Moas N.Z. Austr., 108, 1949.

Genus Zelornis

Premaxilla broad with blunt tip and high arched culmen; distance from septum to tip very short. Anterior part of nasal process deeper than in *Euryapteryx.* Temporal and lambdoidal ridges separated by a moderately wide space. Mandible U-shaped, the rami nearly parallel, the symphysis short.

Sternum with no channel inside the front margin. Upper profile of ilia slightly arched.

Zelornis and *Euryapteryx* differ from the other genera of moas in the broad high premaxilla, U-shaped mandible and maxilla without antrum. *Zelornis* has these features considerably more pronounced than has *Euryapteryx.*

Two rare species comprise this genus, a small bird from the North Island and a large heavy species from Otago.

Key to Species (Lengths in cm.).

	Skull	Pelvis	Femur	Tibia	Metatarsus
Z. exilis	10		20	34	14
Z. haasti	13-15	46-54	32	52	22

Reference.—Oliver, Moas N.Z. Austr., 117, 1949 (*Zelornis,* type *Euryapteryx exilis* Hutton).

Zelornis exilis

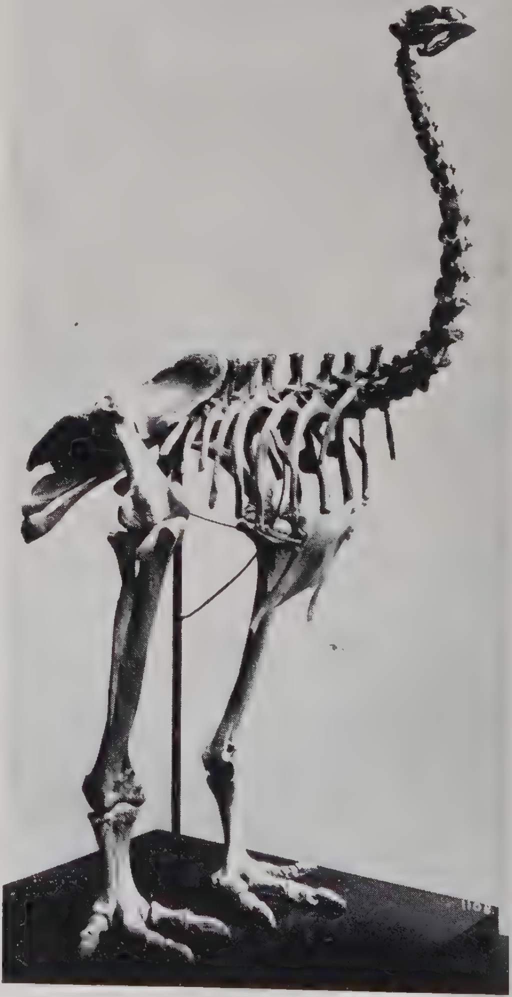
This species is known from a single skeleton only. It was found on sandhills near the Wangaehu River mouth about 1895 and is now preserved in the Wanganui Museum. Although it is a midget compared with *Z. haasti* the characters of the skull are essentially the same in both species.

Skeleton, type, from Wangaehu: Skull, length 96, width 58; sternum, width at precostals 140; pelvis, width 155; femur, length 201, tibia 341, metatarsus 143 mm.

References.—Hutton, Trans. N.Z. Inst., 29, 552, 1897 (*Euryapteryx exilis,* Wangaehu). Archey, The Moa, 57, 1941. Oliver, Moas N.Z. Austr., 121, 1949.

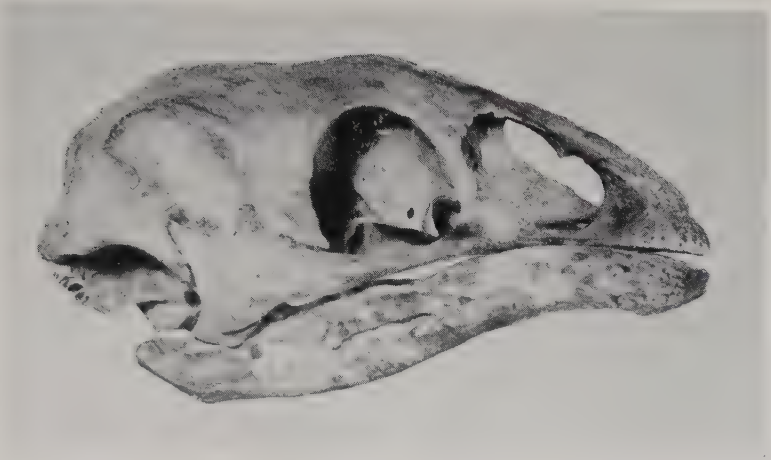
Zelornis haasti

There is an almost complete skeleton of this species from Riverton in the Otago Museum. *Z. haasti* was a massive bird about the same size as *Euryapteryx gravis.* The



Riverton *Otago Museum*

ZELORNIS HAASTI



Dominion Museum

SKULL OF ZELORNIS HAASTI

symphysis of the mandible is proportionately longer than it is in *Z. exilis,* though not so long as in *Euryapteryx.*

Skeleton from Riverton: Skull, length 132, width 78; sternum, width at precostals 215; pelvis, length 459, width 237; femur, length 315; tibia 520, metatarsus 217 mm.

Distribution. South Island: Enfield, Shag River, Riverton.

References.—Rothschild, Ext. Birds, 210, 1907 (*Emeus haasti*); p. 211 (*E. parkeri,* Hamilton Swamp). Hamilton, Trans. N.Z. Inst., 30, 445, 1898 (Riverton). Oliver, Moas N.Z. Austr., 125, 1949.

Subfamily Anomalopteryginae

Width of skull at postorbital processes about the same as at zygomatic processes. Temporal fossae wide and spreading somewhat over the cranium. Escutcheon of pelvis short, abruptly narrowing in front at lateral angles, and sloping backwards and downwards more or less steeply from the acetabular crest.

Key to Genera

Preorbital plate curved. Temporal and lambdoidal ridges in contact	*Anomalopteryx*
Preorbital plate angled. Temporal and lambdoidal ridges not in contact	*Megalapteryx*

GENUS ANOMALOPTERYX

Premaxilla narrow, blunt-pointed. Culmen downcurved in front. Temporal and lambdoidal ridges in contact (sometimes a space 1-4 mm. between them). Temporal fossae spreading backwards and upwards over the cranium. Squamosal and its zygomatic process form a sharp-pointed cone.

Sternum with coracoid pits usually deep. Escutcheons of pelvis shield shaped, the front edge abruptly narrowing from the lateral angles. The escutcheon slopes downwards and backwards from the acetabular region though not so steeply as in *Megalapteryx.* The anterior part of the pelvis is narrow but less so than in *Megalapteryx.*

Anomalopteryx, with its conical squamosals, broad preorbital region, wide temporal fossae and narrow downcurved culmen, is quite distinct from the other genera of moas, resembling in its general features only *Megalapteryx.*

Key to Species (*Lengths in cm.*)

	Skull	Pelvis	Femur	Tibia	Metatarsus
A. oweni	10.5	25	14-16	24-28	11-13
A. parvus	12-13	26-31	20-23	31-35	15-17
A didiformis	13-15	33-36	23-26	35-43	17-20

References.—Reichenbach, Syst. Vogt., p. XXX, 1852 (*Anomalopteryx,* type *Dinornis didiformis* Owen). Archey, The Moa, 14, 1941. Oliver, Moas N.Z. Austr., 129, 1949.

Anomalopteryx oweni

This is the smallest species of moa. Bones were found by G. Thorne at Pataua, near Whangarei, in 1875. Later T. F. Cheeseman visited the locality and collected a skeleton and this was described by Haast as the type of the species. It is preserved in the Auckland Museum.

Skeleton, type, from Pataua: Skull, length 105, width 62; femur, length 143, tibia 243; metatarsus 113 mm. Pelvis from Te Aute, length 250, width 130 mm.

Distribution. North Island: Lake Ohia, Pataua, Te Aute, Martinborough, Makirikiri.

References.—Haast, Trans. Zool. Soc., 12, 171, 1886 (*Dinornis oweni,* Pataua). Oliver, Moas N.Z. Austr., 134, 1949.

Anomalopteryx parvus

The type specimen of this species is an almost complete skeleton found about 1880, in a cave at Takaka, by W. J. Upton. It was forwarded to the British Museum and was described by Owen. The species differs from *A. didiformis* only in its smaller size.

Skeleton, type, from Nelson: Skull, length 130, width 73; sternum, width at precostals 120; pelvis, length 285, width 128; femur, length 205, tibia 326, metatarsus 162 mm.

Distribution. North Island: Mangaotaki, Hangatiki, Tahora, Waikaremoana, Pohue, Coonoor, Martinborough, Makirikiri, Lake Kaitoke, Levin. South Island: Takaka Hill, Waiau, Broken River, Castle Rock, Hamilton Swamp, Papatowai.

References.—Owen, Trans. Zool. Soc., 11, 233, 1883 (*Dinornis parvus,* Takaka). Oliver, Moas N.Z. Austr., 138, 1949.

Anomalopteryx didiformis

Bones of this species were included in the first shipment forwarded to England by the Rev. W. Williams who discovered them in Poverty Bay about 1840. It has since been found in many localities throughout both the North and the South Islands. Eggs from Kaiiwi, near Wanganui, and Tukituki River, Hawke's Bay, are tentatively assigned to *A. didiformis.* At Shag River and Papatowai bones have been obtained from Maori camp sites.

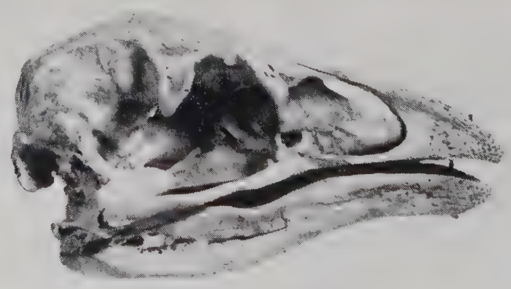
Skull from Castle Rock, length 144, width 77; sternum, Martinborough, width at precostals 146; pelvis, Mangaone, length 363, width 167; leg bones, Mangaone, femur, length 250, tibia 395, metatarsus 188 mm.

Distribution. North and South Islands. Common throughout.

References.—Owen, Trans. Zool. Soc., 3, 242, 1844 (*Dinornis didiformis,* Poverty Bay). Archey, The Moa, 14, 1941. Oliver, Moas N.Z. Austr., 141, 1949.

Anomalopteryx antiquus

This name was given to some fragmentary bones found in a bed of clay of Upper Miocene or Lower Pliocene age under a dolerite flow in Gleniti Valley, near Timaru. The



Pohue, Hawke's Bay *Dominion Museum*

SKULL OF ANOMALOPTERYX DIDIFORMIS

bones were a little smaller than those of *A. parvus.* The most important character seems to be the middle trochlea of the metatarsus not projecting so far forward as in all other moas. Possibly this may be a primitive feature.

References.—Hutton, Trans. N.Z. Inst., 24, 124, 1892 (*A. antiquus,* Gleniti). Archey, The Moa, 29, 1941. Oliver, Moas N.Z. Austr., 144, 1949.

GENUS MEGALAPTERYX

In profile the premaxilla is more pointed and less elevated than in *Anomalopteryx.* It is also more downcurved at the tip. The nasal process is thin in front whereas in all other moas it thickens at this point. Temporal and lambdoidal ridges separated by a space. Temporal fossae wide. Preorbital plate arising at a wide angle and then turning forwards.

Sternum with xiphoid process rather wide, notched. Lateral processes moderately diverging. Profile of iliac crests slightly curved above but descending abruptly in front. Preacetabular portion of ilia narrow and conspicuously longer than postacetabular portion. Escutcheon short, sloping steeply downwards and backwards from the acetabular region.

Megalapteryx stands close to *Anomalopteryx* in the large size of the temporal fossae, great breadth between the supraorbital ridges, downcurved tip to the bill and short sloping escutcheon. It differs in the peg-like zygomatic processes, the presence of a space between the temporal and lambdoidal ridges, the more widely diverging preorbital plates and the more pointed and thinner triangular processes.

Key to Species (Lengths in cm.)

	Skull	Pelvis	Femur	Tibia	Metatarsus
M. hectori ...			20-22	31-34	14-16
M. didinus ...	11-12	32-36	23-27	37-41	16-20
M. benhami			29-32	45	

References.—Haast, Trans. Zool. Soc., 12, 161, 1886 (*Megalapteryx,* type *M. hectori*). Oliver, N.Z. Birds, 42, 1930. Archey, The Moa, 29, 1941. Oliver, Moas N.Z. Austr., 146, 1949.

Megalapteryx hectori

This small species was first described from a set of leg bones discovered in the Takaka district in 1885. Similar bones have since been obtained from a few other localities in the South Island. At Papatowai bones were obtained from a Maori camp site.

Leg bones from Nelson, types: femur, length 200, tibia 307, metatarsus 144 mm.

Distribution. South Island: Takaka, Kapua, Maniototo Plain, Papatowai.

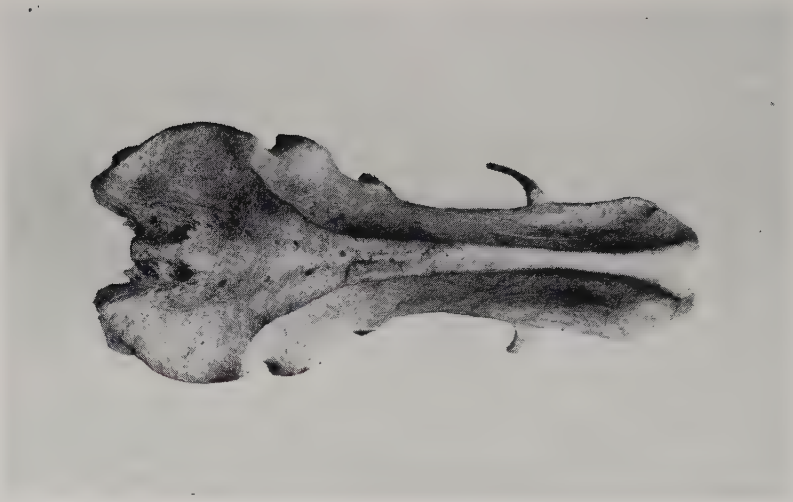
References.—Haast, Trans. Zool. Soc., 12, 161, 1886 (*M. hectori,* Takaka). Oliver, Moas N.Z. Austr., 149, 1949.

Megalapteryx didinus

In 1878 H. L. Squires obtained near Queenstown the remains of a moa with the skin still attached to the head and feet. Part of this was forwarded to the British Museum a few years afterwards and was the basis of the species *Dinornis didinus* of Owen. Two nearly complete skeletons are known, one found at Pokororo and now in the British Museum, and the other found near Cromwell and now preserved in the Dominion Museum, Wellington. This species evidently ranged from near sea level to high up on the mountains. Recently, 1949, its remains were found in caves above Lake Te Anau, at an altitude of 3,000 feet, associated with bones of the takahe and kakapo and with Maori artifacts. The Cromwell specimen has skin and flesh, but not feathers, on the head and upper portion of the neck. One of the eyes is dried in its socket. In the Otago Museum is a dried leg from the Old Man Range, with ligaments, skin and feathers attached.

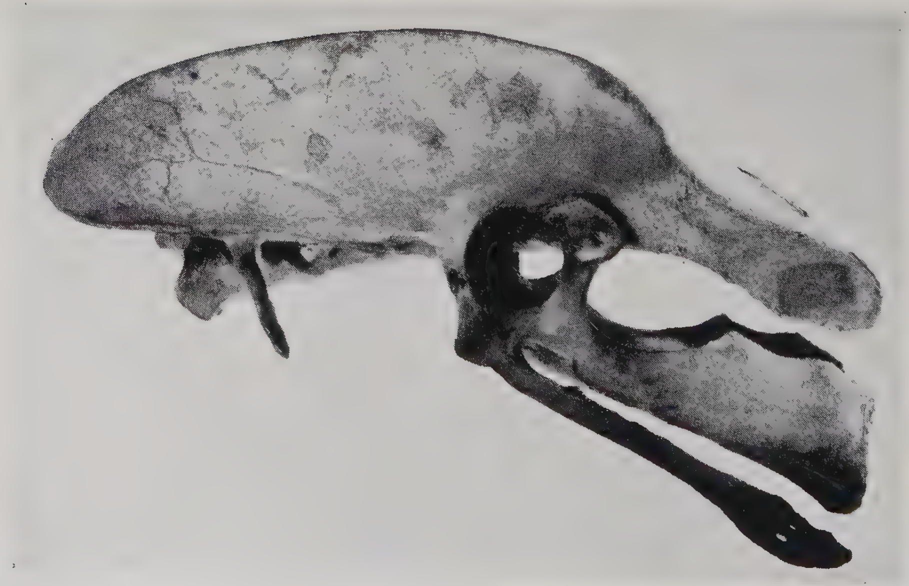
Skeleton from Pokororo: Skull, length 122, width 73; sternum, width at precostals 104; pelvis, length 320, width 140; femur, length 265, tibia 405, metatarsus 190 mm.

Distribution. South Island: D'Urville Island, Mount Arthur, Pokororo, Inangahua, Glenmark, Kapua, Cromwell, Old Man Range, Manuherekia, Maniototo Plains, Queenstown, Kingston, Papatowai, Te



Cromwell *Dominion Museum*

PELVIS OF MEGALAPTERYX DIDINUS



Cromwell *Dominion Museum*

PELVIS OF MEGALAPTERYX DIDINUS

Anau. The North Island locality Waingongoro recorded by Rothschild is doubtful.

References.—Owen, Trans. Zool. Soc., 11, 257, 1883 (*Dinornis didinus,* Queenstown). Andrews, Nov. Zool., 4, 188, 1897 (*Pokororo*). Archey, The Moa, 30, 1941. Oliver, Moas N.Z. Austr., 151, 1949.

Megalapteryx benhami

This species is known only from a femur and tibia from Mount Arthur in the Auckland Museum and a femur from Wairangi in the Dominion Museum. Both localities are in the Nelson district.

Leg bones from Mount Arthur: Femur, length 293, width proximal 92, middle 39, distal 93; tibia, length 454, width proximal 109, middle 39, distal 65 mm.

References.—Archey, The Moa, 35, 1941 (*M. benhami,* Mount Arthur). Oliver, Moas N.Z. Austr., 156, 1949.

FAMILY DINORNITHIDAE

Bill broad, flattened, downcurved at the tip. Preorbital plate connected with the basisphenoidal rostrum by a strong transverse ridge. Nape vertebrae with single neural spines. Shaft of tibia parallel sided. One genus only.

GENUS DINORNIS

Besides the characters given for the family the following are diagnostic. Top of cranium broad and flattened but with a prominent elevation at a level with the postorbitals. Width at postorbitals considerably greater than at squamosals. Temporal fossae wide. Temporal and lambdoidal ridges separated by a wide space. Maxillo-palatines wide and flattened with the antrum opening transversely, elongate. Mandible strongly downcurved in front.

Sternum body wider than long (front to sinus), distorted, the left side bulging downwards more than the right. Xiphoid process rather broad, notched. Lateral processes diverging considerably, bowed outwards. Leg bones proportionately more slender than in any other genus of moas.

Key to Species (Lengths in cm.)

	Skull	Pelvis	Femur	Tibia	Metatarsus
D. gazella ...		32(est.)	23	46-48	25-28
D. novaezealandiae	16-17	34-38	24-29	48-56	25-32
D. torosus ...	17	42-45	23-33	53-65	26-33
D. ingens ...	17	48-51	32-37	65-80	33-42
D. robustus	20	51-52	34-39	66-75	34-42
D. hercules			35	74-83	41-43
D. giganteus		56-57	41-42	89-97	47-53
D. maximus	21-23	54-57	40-47	78-99	41-55

References.—Owen, Proc. Zool. Soc., 1843, p. 10 (*Dinornis,* type *D. novaezealandiae*). Archey, The Moa, 61, 1941. Oliver, Moas N.Z. Austr., 159, 1949.

Dinornis gazella

The miniature pelvis on which this species was based was found at Te Aute by A. Hamilton in 1888. It is now in the Dominion Museum, Wellington. Leg bones have been obtained in this and other localities but no skulls have been collected.

Bones from Te Aute: Pelvis, length 320, width 145; femur, length 231, tibia 470, metatarsus 261 mm.

Distribution. North Island: Karamu, Te Aute, Makirikiri, Paremata.

Reference.—Oliver, Moas N.Z. Austr., 166, 1949 (*D. gazella,* Te Aute).

Dinornis novaezealandiae

This is the first species of moa to receive a specific name. Professor Owen, as early as 1843, described it from bones collected at Poverty Bay by the Rev. W. Williams about 1840. To this species, also, belongs the first moa bone to be taken to England. It was the shaft of a femur collected in the Poverty Bay district about 1837 and taken to England by Dr. Rule. Professor Owen identified it as a bird bone. This species was fairly common in the North Island and bones of similar size and robustness have been obtained in the South Island.

Skeleton from Waikaremoana: Skull, length 170, width 109; sternum, width at precostals 155; pelvis, length 342, width 176; femur, length 276, tibia 526, metatarsus 282 mm.

Distribution. North Island: Doubtless

Bay, Waipu, Mangaotaki, Poverty Bay, Waikaremoana, Tahora, Haupouri, Te Aute, Martinborough, Makirikiri, Paremata. South Island: Takaka Hill, Slovens Creek (Canterbury).

References.—Owen, Proc. Zool. Soc., 1843, p. 8 (*Dinornis novae-zealandiae,* Poverty Bay). Archey, The Moa, 64, 1941. Oliver, Moas N.Z. Austr., 167, 1949.

Dinornis torosus

This species is taller and more robust than *D. novae-zealandiae.* It was described from a skeleton found at Takaka by R. I. Kingsley about 1891.

Skeleton, type, from Takaka: Skull, length 173, width 105; sternum, width at precostals 184; pelvis, length 430, width 200; femur, length 295, tibia 605, metatarsus 315 mm. (Auckland Museum.)

Distribution. South Island: Takaka, Mount Arthur, Broken River, Glenmark, Timaru, Enfield, Herbert, Shag River, Hamilton Swamp, Castle Rock.

References.—Hutton, N.Z. Jour. Sci., 1, 244, 1891 (*Dinornis torosus,* Takaka), Archey, The Moa, 70, 1941. Oliver, Moas N.Z. Austr., 170, 1949.

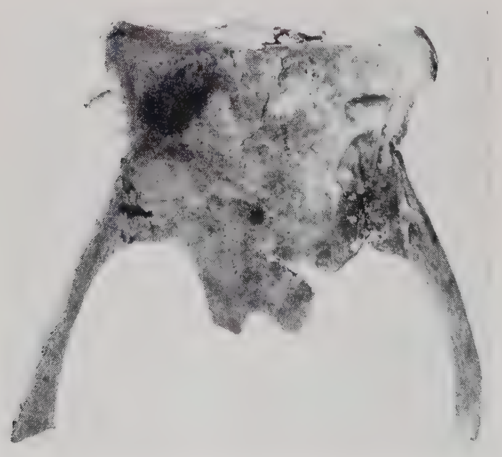
Dinornis ingens

This species was founded on a tibia from Poverty Bay, being one of the first bones forwarded to England by the Rev. W. Williams. *D. ingens* is typically a North Island species but bones of quite similar dimensions have been obtained in the South Island. It differs from *D. hercules* in being much less robust.

Skull, Waikaremoana, length 173, width 110 mm. Skeleton, Waikaremoana: Pelvis, length 478, width 204; femur, length 353, tibia 672, metatarsus 370 mm.

Distribution. North Island: Ruakaka, Matapouri, Clevedon, Karamu, Te Kuiti, Mangaotaki, Poverty Bay, Moawhango, Waikaremoana, Te Aute, Patangata, Kaikawa, Hastings, Coonoor, Martinborough, Karori, Paekakariki, Makirikiri, Kaiiwi. South Island: Takaka Hill, Westport, Broken River.

References.—Owen, Trans. Zool. Soc., 3, 247, 1844 (*Dinornis ingens,* Poverty Bay). Archey, The Moa, 68, 1941. Oliver, Moas N.Z. Austr., 170, 1949.



Takaka *Dominion Museum*
STERNUM OF DINORNIS TOROSUS

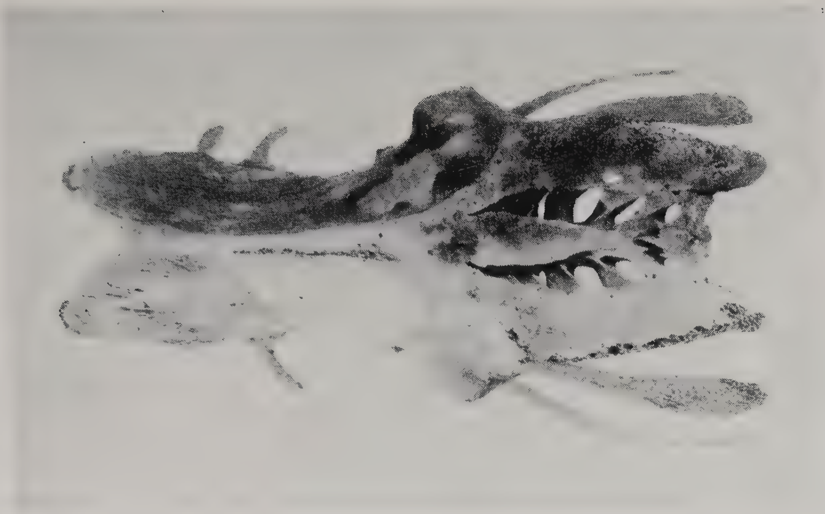
Dinornis robustus

Professor Owen, as early as 1846, separated this form, as a variety of *D. ingens.* Evidently it was common throughout the South Island where it occupied a middle position between the smaller *D. torosus* and the larger *D. maximus.* It is near to though not quite so large as *D. hercules* of the North Island. The bones from Papatowai are from a Maori midden; a skull from Clyde is fossilized; while the metatarsus from Knobby Range, in the Otago Museum, has skin, muscles and ligaments attached.

Skull, Tiger Hill, length 200, width 127 mm. Skeleton, Pyramid Valley: Sternum, width at precostals 215; pelvis, length 506, width 273; femur, length 350, tibia 717, metatarsus 370 mm,

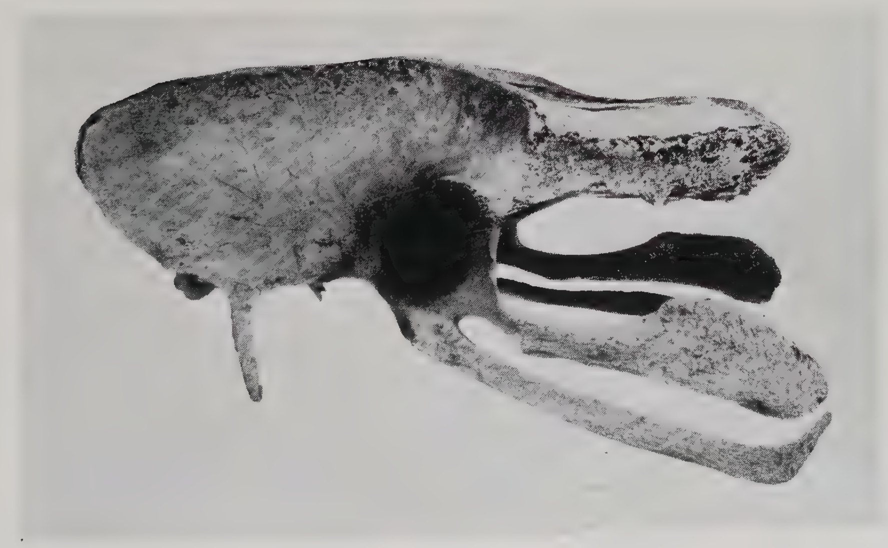
Distribution. South Island: D'Urville Island, common throughout.

References.—Owen, Proc. Zool. Soc., 1846, p. 48 (*Dinornis ingens* var. *robustus,* South Island). Archey, The Moa, 71, 1941. Falla, Rec. Cant. Mus., 4, 346, 1941. Oliver, Moas N.Z. Austr., 173, 1949.



Takaka *Dominion Museum*

PELVIS OF DINORNIS TOROSUS

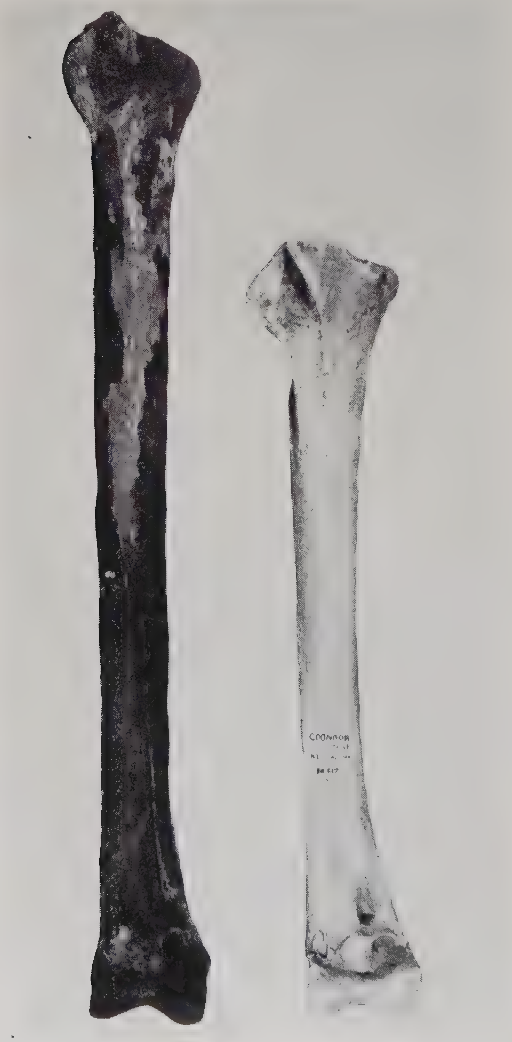


Takaka *Dominion Museum*

PELVIS OF DINORNIS TOROSUS

Dinornis hercules

This species is founded on some very robust bones from the North Island, the type tibia being from Coonoor. The shaft of the tibia is as wide as that of *D. giganteus* but is much shorter and more curved. In length the tibia is near that of *D. ingens* and *D. robustus* but is wider than this bone in either of these species.



Dominion Museum

TIBIAE OF DINORNIS GIGANTEUS, OMARANUI, and D. HERCULES, COONOOR

Tibia, type, from Coonoor, length 742, width proximal 179, middle 59, distal 110 mm. Femur, Coonoor, length 353, metatarsus 417 mm.

Distribution. North Island: Waitomo, Mangaone, Te Aute, Coonoor, Makirikiri. Similar bones have been obtained from Doubtless Bay, Moawhango, Poverty Bay and Awhitu.

Reference.—Oliver, Moas N.Z. Austr., 174, 1949 (*D. hercules,* Coonoor).

Dinornis giganteus

Dinornis giganteus, the largest of the North Island moas, was first obtained in Poverty Bay by the Rev. W. Williams about 1840. Its bones were included in the first shipment forwarded to Professor Owen. It is as tall as the South Island species, *D. maximus,* but rather more slender. The tibia is straight as in some South Island *D. maximus.* The species was not common and no individual skeleton has been collected.

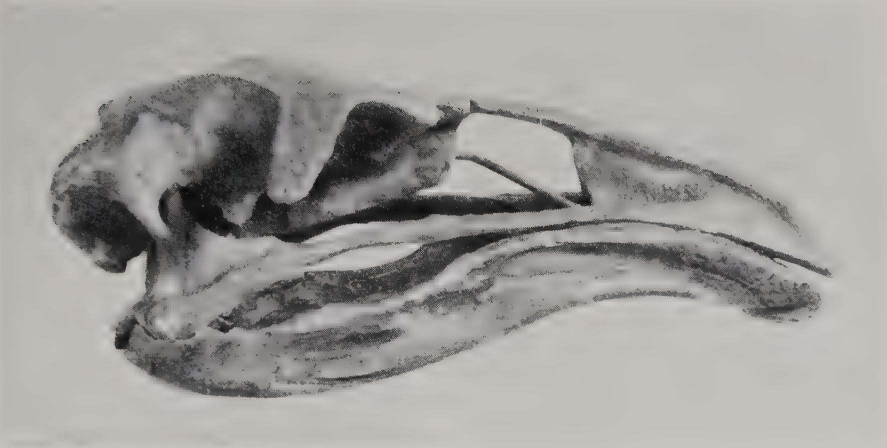
Skull, Martinborough, width 134; pelvis, Makirikiri, length 565, width 257; femur, Omaranui, length 428; tibia, Omaranui, length 942; metatarsus, Makirikiri, length 532 mm.

Distribution. North Island: Poverty Bay, Te Aute, Coonoor, Omaranui, Maungaraki Range, Martinborough, Makirikiri.

References.—Owen, Proc. Zool. Soc., 1844, p. 144 (*Dinornis giganteus,* Poverty Bay). Archey, The Moa, 69, 1941. Oliver, Moas N.Z. Austr., 174, 1949.

Dinornis maximus

The first description of this species was published by Haast in 1869, based on a set of leg bones found in the Glenmark swamp in 1865. The other leg bones of the same individual bird had been sent to Professor Owen by Major J. Michael and these Owen named *maximus* but Haast's name, also *maximus,* was published a few weeks before Owen's. Some of the tibiae of this species are very long and straight, quite resembling those of *D. giganteus.* The majority, however, are slightly curved and a little shorter. Glenmark and the near Pyramid Valley mark



Cast in Dominion Museum

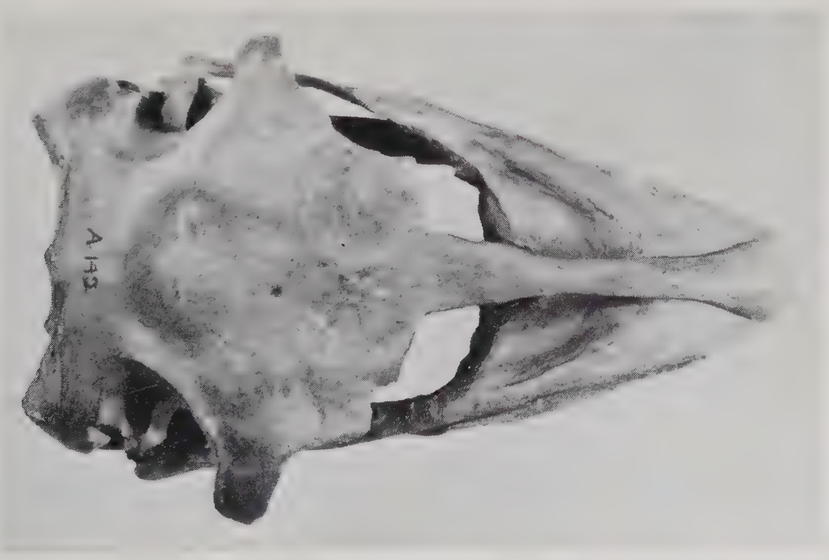
SKULL OF DINORNIS MAXIMUS

the northern limit of the species. Complete or nearly complete skeletons are known from Pyramid Valley (several in Canterbury Museum) and Invercargill (one in British Museum).

Skull, Pyramid Valley, length 230, width 147; sternum, Pyramid Valley, width at precostals 320; pelvis (same skeleton) length 565, width 277 mm. Leg bones, Glenmark, types; Femur, length 470, tibia 990, metatarsus 518 mm.

Distribution. South Island: Glenmark, Pyramid Valley, Broken River, Raki's Table, Herbert, Awamoa, Seacliff, Riverton, Colac Bay.

References.—Haast, Trans. N.Z. Inst., 1, 87, 1869 (*Dinornis maximus,* Glenmark). Owen, Trans. Zool. Soc., 6, 497, 1869 (*D. maximus,* same bird). Archey, The Moa, 72, 1941. Falla, Rec. Cant. Mus., 4, 344, 1941. Oliver, Moas N.Z. Austr., 175, 1949.



Cast in Dominion Museum

SKULL OF DINORNIS MAXIMUS

OTHER EXTINCT BIRDS

FAMILY SPHENISCIDAE

Genus Palaeeudyptes

Humerus with massive head with arched articular surface. Insertion of pectoralis secundus straight along axis of shaft and far removed from that of latissimus dorsi. Shaft tapering distally with no preaxial angle. Clavicle with a hypocleidium. Second and third metatarsals closely united, with no groove and only a minute vacuity between them. Groove and small vacuity between third and fourth metatarsals. Fourth metatarsal straight. (Type metatarsus of *P. antarcticus.*)

Differs from *Pachydyptes* in the less massive humerus without the angle on the preaxial border. It also differs in the insertion of the pectoralis secundus being straight instead of curved, and the more tapering shaft.

References.—Huxley, Quart. Jour. Geol. Soc., 15, 671, 1859 (*Palaeeudyptes,* type *P. antarcticus* Huxley). Simpson, Bull. Am. Mus. Nat. Hist., 87, 40, 1946. Marples, N.Z. Geol. Surv. Pal. Bull., 20, 28, 1952.

Palaeeudyptes antarcticus

The metatarsus on which Huxley based this genus and species was forwarded to him by W. B. D. Mantell who obtained it from limestone of Lower Oligocene age at Kakanui, near Oamaru, about 1857. In 1869 J. Duigan discovered some wing and leg bones of the same species in a reef exposed only at low water at Seal Rock on the south-west coast of Nelson Province.

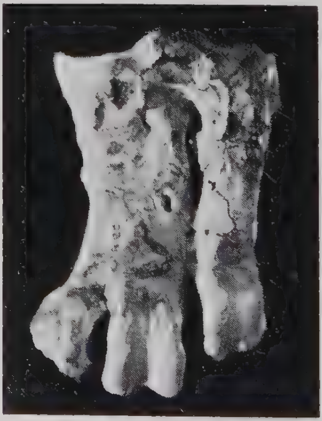
Humerus. Length 172, width at head 49 mm. (Duntroon). *Ulna.* Length 115, width 37 mm. (Duntroon). *Radius.* Length 119 (approx.), width 24 mm. (Duntroon). *Coracoid.* Length 204, width at base 100 mm. (approx.) (Duntroon). *Femur.* Length 145 (approx.) (Burnside). *Tibia.* Length 228 (approx.) (Duntroon). *Metatarsus.* Length 75, width proximal end 42, centre 30, distal 45 mm. (Burnside).

Localities. Seal Rock. Kakanui. Duntroon. Burnside. *Age.* Kaiatan, Upper Eocene (Burnside). Duntroonian, Lower Oligocene (Seal Rock, Duntroon). Probably Whaingaroan, Lower Oligocene (Kakanui). Waitakian, Middle Oligocene (Burnside).

References.—Huxley, Q.J.G.S., 15, 671, 1859 (*P. antarcticus,* Kakanui). Hector, Trans. N.Z. Inst, 4, 341, 1872. Oliver, N.Z. Birds, 85, 1930. Simpson, Bull. Am. Mus. Nat. Hist., 87, 40, 1946. Marples, N.Z. Geol. Surv. Pal. Bull., 20, 30, 1952.

Genus Pachydyptes

Humerus relatively wide. External tuberosity prominent and articular surface flattened thus giving a square appearance to the head. Insertion of pectoralis secundus slightly curved towards the postaxial margin, widely separated from insertion of latissimus dorsi. Shaft with gentle sigmoid curve and a slight angle on preaxial border. (Type humerus of *P. ponderosus.*) Metacarpus with conspicuous groove on ventral side between first and second metacarpals, in one place it extends through to the dorsal side. Vacuity between second and third metacarpals open along almost whole length. Coracoid with



Burnside *Otago Museum*

METATARSUS OF PALAEEUDYPTES ANTARCTICUS

angle at distal end of glenoid surface prominent, base convex.

The humerus differs from that of *Palaeeudyptes* in its larger size, squarish head, curved insertion of pectoralis secundus, and parallel-sided shaft with angle on preaxial border.

One species from Lower Eocene of Oamaru district.

References.—Oliver, N.Z. Birds, 85, 1930 (*Pachydyptes,* type *P. ponderosus* Oliver). Simpson, Bull. Am. Mus. Nat. Hist., 87, 41, 1946. Marples, N.Z. Geol. Surv. Pal. Bull., 20, 35, 1952.

Pachydyptes ponderosus

Three bones in an excellent state of preservation, humerus, metacarpus and coracoid, were found by Charles Traill some time before 1872 in a white calcareous sandstone at Fortification Hill, near Oamaru. They are preserved in the Dominion Museum, Wellington. This is the largest of all known penguins, recent or extinct.

Humerus. Length 179, width of head 66 mm. *Metacarpus.* Length 103, width 34 mm. *Coracoid.* Length 225 (approx.), width at base 120 mm. (approx.).

Fortification Hill *Dominion Museum*
CORACOID, METACARPUS and FEMUR OF PACHYDYPTES PONDEROSUS

Locality. Fortification Hill. *Age.* Runangan, Upper Eocene.

References.—Oliver, N.Z. Birds, 86, 1930 (*Pachydyptes ponderosus,* Fortification Hill). Hector, Trans. N.Z. Inst., 5, 438, 1873. Simpson, Bull. Am. Mus. Nat. Hist, 87, 41, 1946. Marples, N.Z. Geol. Surv. Pal. Bull, 20, 36, 1952.

GENUS PLATYDYPTES

Humerus relatively broad with massive squarish head. Insertion of pectoralis secundus oblique, separated from that of latissimus dorsi. Slight angle in preaxial border. Ulna with smoothly curved postaxial border. Radius with proximal part of preaxial border sharply concave. Coracoid broad and convex at base with complete praecoracoid foramen. Clavicle with a hypocleidium.

The humerus differs from that of *Pachydytes* in the insertion of the pectoralis secundus extending to the preaxial margin and approaching the insertion of the latissimus dorsi, and in the wider angle between the axis of the shaft and the tangent to the distal condyles. *Platydyptes* differs from *Archaeospheniscus* in the relatively broader humerus and the proximal part of the preaxial border of the radius being concave.

Two species from the Oligocene of the Oamaru district.

Reference.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 37, 1952 (*Platydyptes,* type *Pachydyptes novaezealandiae* Oliver).

Platydyptes novaezealandiae

This species was discovered in the Oamaru district probably before 1880. The bones collected included a humerus, ulna and radius almost in their original relative positions. These are in the Dominion Museum. Another set of bones obviously from a single individual and including wing bones, coracoids, clavicle, scapulae and part of the sternum, probably from the Waitaki Valley, is in the Otago Museum.

Humerus. Length 104, width of head 34 mm. (approv.) (type). *Ulna.* Length 78, width 23 mm. (Type). *Radius.* Length 78, width 18 mm. (Type). *Carpus.* Length 52.5

mm. *Coracoid.* Length 122 (approx.), width at base 44 mm.

Localities. Oamaru district (Type and paratype). Duntroon. *Age.* Waitakian, Middle Oligocene (Type). Duntroonian, Lower Oligocene (Paratype and Duntroon).

References.—Oliver, N.Z. Birds, 86, 1930 (*Pachydyptes novaezealandiae,* Oamaru district). Simpson, Bull. Am. Mus. Nat. Hist., 87, 41, 1946. Marples, N.Z. Geol. Surv. Pal. Bull., 20, 37, 1952.

Platydyptes amiesi

The first bone of this species to be collected was an incomplete radius found by A. C. Amies at Duntroon in 1946. In 1948 B. J. Marples collected a humerus and a radius in the Hakataramea Valley and on these he based his description of the species.

Hakataramea Valley *Otago Museum*
RADIUS OF PLATYDYPTES AMIESI

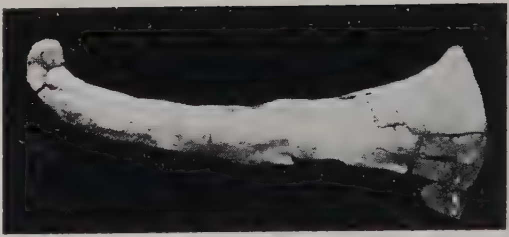
Humerus. Length 118, width at head 41. (Type). *Radius.* Length 89, width 22 mm. (Type).

Localities. Hakataramea Valley (Type). Duntroon. *Age.* Waitakian, Middle Oligocene (Type). (According to Marples the Duntroon specimen may be Duntroonian, Lower Oligocene.)

Reference.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 39, 1952 (*Platydyptes amiesi,* Hakataramea Valley).

GENUS ARCHAEOSPHENISCUS

Humerus with angles on both borders giving it a distinct sigmoid appearance. Insertion of pectoralis secundus oblique, separated by a gap from that of latissimus dorsi. Ulna with proximal border forming a smooth curve. Coracoid convex at base. Tarsus with all the metatarsals curved.



Duntroon *Otago Museum*
CORACOID OF ARCHAEOSPHENISCUS LOWEI

Differs from *Platydyptes* in the relatively narrow humerus, the more obtuse angle between the dorsal margin of head and shaft, and the more widely open capsular groove.

Two species from the Oligocene of New Zealand.

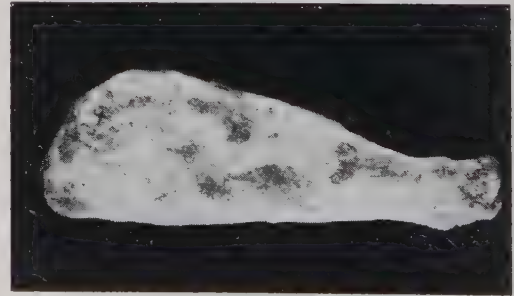
Reference.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 40, 1952 (*Archaeospheniscus,* type *A. lowei* Marples).

Archaeospheniscus lowei

A femur of this species was discovered by M. J. Marples in 1942 at Duntroon, North Otago. The following year several bones belonging to an individual bird were found in the same locality.

Humerus. Length 128, width of head 37. *Ulna.* Length 83 (approx.), width 27 mm. *Radius.* Length 84, width 18 mm. *Coracoid.* Length 153 (+), width at base 58 mm. (approx.). *Femur.* Length 106 (+). *Tibia.* Length 173 (+). (Types).

Locality. Duntroon. *Age.* Duntroonian, Lower Oligocene.



Duntroon *Otago Museum*
ULNA OF ARCHAEOSPHENISCUS LOWEI

Reference.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 40, 1952 (*Archaeospheniscus lowei,* Duntroon).

Archaeospheniscus lopdelli

Several bones belonging to an individual skeleton of this species were found by Professor Marples at Duntroon in 1943.

Ulna. Length 95, width 31.5 mm. *Radius.* Length 98 (approx.), width 21 mm. *Femur.* Length 121 (+) mm. *Tibia.* Length 196 mm. (approx.). *Metatarsus.* Length 58 mm.

Locality. Duntroon. *Age.* Duntroonian, Lower Oligocene.

Reference.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 41, 1952 (*Archaeospheniscus lopdelli,* Duntroon).

GENUS DUNTROONORNIS

All the metatarsals curved in the preaxial direction; second and third closely united with no groove and only a minute vacuity between them; groove and a small vacuity between third and fourth.

This metatarsus resembles that of *Archaeospheniscus* in being curved in the preaxial direction, but it is relatively narrower, much smaller, and has very small intermetatarsal vacuities.

One species from the Lower Oligocene of Duntroon.

References.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 42, 1952 (*Duntroonornis,* type *D. parvus* Marples).

Duntroonornis parvus

The only specimen of this species so far collected is a metatarsus found by B. J. Marples at Duntroon, North Otago, in 1944. It is preserved in the Otago Museum.

Metatarsus. Length 32, width proximal 16.5 (approx.), middle 15, distal 18.5 mm.

Locality. Duntroon. *Age.* Duntroonian, Lower Oligocene.

Reference.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 42, 1952 (*D. parvus,* Duntroon).

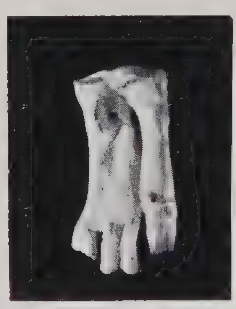
GENUS KORORA

Metatarsus with concave preaxial border and straight postaxial border. Second and third metatarsals closely united with only a small vacuity between them and a slight groove on the dorsal surface. Vacuity between third and fourth metatarsals about twice the size of the other and a groove between these bones on the dorsal surface.

Differs from *Duntroonornis* in the straight postaxial border of the metatarsus, which also is longer in proportion to the width. According to Marples the metatarsus of *Korora* is similar in general shape and proportions to that of *Delphinornis* of Seymour Island. *Delphinornis* has the trochlea of the fourth metatarsal diverging whereas in *Korora* it is straight.

One species, *K. oliveri,* from the Middle Oligocene of Hakataramea Valley, South Canterbury.

Reference.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 43, 1952 (*Korora,* type *K. oliveri* Marples).



Hakataramea *Otago Museum*

METATARSUS OF KORORA OLIVERI

Korora oliveri

This species and genus is known only by a single metatarsus found by B. J. Marples in the Hakataramea Valley, South Canterbury, in 1948.

Metatarsus. Length 40, width proximal 18, middle 15, distal 21 mm.

Locality. Hakataramea Valley. *Age.* Waitakian, Middle Oligocene.

Reference.—Marples, N.Z. Geol. Surv. Pal. Bull., 20, 43, 1952 (*Korora oliveri,* Hakataramea Valley).

FAMILY SCOLOPACIDAE

Extinct Chatham Island Snipe

Coenocorypha chathamica

Formerly there existed at the Chatham Islands a snipe much larger than the species now living there, and indeed larger than the Auckland Island Snipe. The skull characters agree precisely with those of *C. pusilla*. The length from the tip of the premaxillae to a line joining the proximal ends of the outer processes of the nasals varies from 68 to 77 mm., whereas in *C. pusilla* it is 54 mm.

References.—Forbes, Ibis, 1893, p. 545 (*Gallinago chathamica,* Chatham Is.). Lowe, Ibis, 1915, p. 697.

FAMILY RALLIDAE

Genus Capellirallus

Bill twice as long as cranium, decurved, gradually tapering to blunt punctate tip. Nasal and maxillary processes of premaxilla long and nearly parallel. Central ridge of mandible projecting so that in lateral view the lower angle of the posterior end appears further backward than the upper angle. Pelvis narrow, postacetabular portion short, with deeply hollowed vertical sides.

In this remarkable bird the cranium, posterior end of mandible and pelvis are like *Rallus,* but the bill, with its long narrow mandibles and its premaxilla with nearly parallel processes, resembles that of scolopacine birds. Of New Zealand rails it probably comes nearest to *Cabalus modestus.*

Reference.—Falla, Rec. Auck. Mus., 4, 241, 1954 (*Capellirallus,* type *C. karamu*).

Cave Rail

Capellirallus karamu

This extinct rail was discovered by members of the New Zealand Speleological Society in a limestone cave at Karamu, near Pirongia, in the Te Kuiti district, in 1950. In the cave an excellent photograph was taken at the time, by the light of five candles, by the President of the Society, Mr. H. G. Lambert. "The skeleton," states Mr. Lambert, "was found resting, partially embedded, on the fairly stiff mud floor of an old dry gallery of the Karamu cave."

Skull length 88, premaxilla 56 mm.; pelvis length 36-38, least width 9, width at antitrochanters 18-20 mm.; femur length 44, tibia 65, metatarsus 37-39 mm.

Type skeleton from Karamu in Auckland Museum.

Distribution. Karamu. Coonoor, Waitanguru.

Reference.—Falla, Rec. Auck. Mus., 4, 241, 1954 (*Capellirallus karamu,* Karamu).

Little Extinct Woodhen

Gallirallus minor

Several bones of a small species of rail closely allied to the recent species of Gallirallus were discovered by A. Hamilton in Pleistocene deposits at Castle Rocks. In their measurements these bones are slightly larger than those of *Tricholimnas sylvestris* of Lord Howe Island, but the tibia is smaller.

Pelvis, length 65, width 28; femur, length 64; tibia, length 93; metatarsus, length 53; sternum, breadth 24.5 mm.

Distribution. Takaka, Lake Grassmere, Pyramid Valley, Forest Hill, Hamilton Swamp, Lime Hills, Castle Rocks.

Reference.—Hamilton, Trans. N.Z. Inst., 25, 103, 1893 (*Ocydromus minor,* Castle Rocks).

Genus Diaphorapteryx

Skull with long, tapering and pointed premaxillae, both mandibles decurved. Nasal opening one third the length of the premaxilla. Upper margins of orbits bevelled. Cranium from above hexagonal, post-orbital processes prominent. Temporal fossae large and deep, the temporal and lambdoidal ridges in contact, prominent. Paroccipital and mammillary processes prominent. Palatines narrow rods widening posteriorly and deeply hollowed between the inner and outer margins; vomer a vertical plate with wide flanges above. Mandible with a long symphysis and prominent posterior processes.

Sternum with low keel diverging in front, coracoid grooves widely separated, precostal processes large, posterior border with three pairs of shallow lateral notches; one of the middle ones may be closed thus forming a fenestrum.

Pelvis typically ralline in having a long preactetabular portion and a short postacetabular portion with vertical hollowed sides.

Diaphorapteryx is related to Gallirallus, but has the wings more reduced, the beak longer, the temporal fossae relatively larger and the cranial processes more strongly developed. It resembles Aphanapteryx of Mauritius, but this is probably due to their origin from related forms.

The single species was confined to the Chatham Islands.

Reference.—Forbes, Ibis, 1893, p. 1893, p. 253 (*Diaphorapteryx,* type *Aphanapteryx hawkinsi* Forbes).

Giant Chatham Island Rail

Diaphorapteryx hawkinsi

The bones of this species were first collected by Mr. W. Hawkins, who forwarded them to Dr. H. O. Forbes in 1892. Forbes later in the year visited the Chatham Islands and collected a large number of bones of extinct birds, including those of Diaphorapteryx.

The principal measurements of this species are: length of skull 144, sternum 68, pelvis 106, femur 106, tibia 140, metatarsus 78 mm.

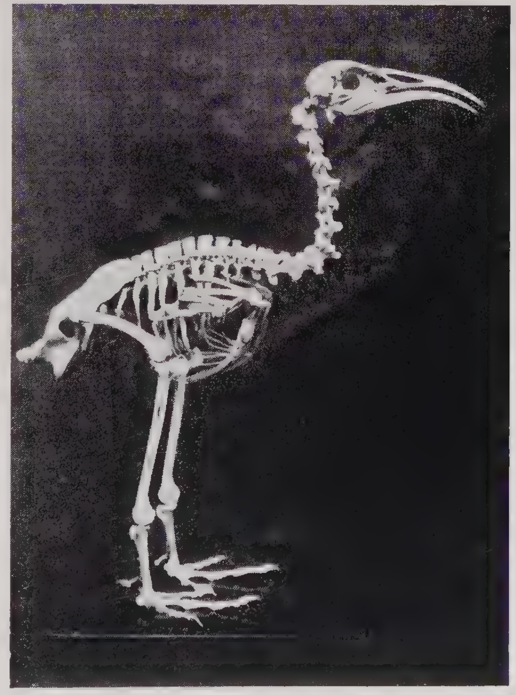
References.—Forbes, Nature, 46, 252, 1892 (*Aphanapteryx hawkinsi,* Chatham Is.). Andrews, Nov. Zool. 3, 73, 1896. Rothschild, Extinct Birds. 133, 1907. Oliver, Emu, 45, 130, 1945.

FAMILY GALLINULIDAE

Genus Pyramida n. gen.

Anterior ends of ilia slope steeply down, from well behind the front of the first pelvic vertabra, for about half their width, margins concave upwards; they then extend forwards, the terminal borders being thickened and fused on the inside to the transverse processes of the first pelvic vertebra. Posterior to the short junction with the iliac crest the upper margins of the ilia bend down for about a third of the width of the ilia then gradually rise reaching the crest again in front of the acetabulum. Iliac crest arched. The postacetabular portion of the pelvis is shorter than the preacetabular portion; its upper surface slopes backwards gradually converging towards the lower border. The ischio-iliac plate slopes away from the upper surface of the pelvis at an angle of about 40° from the vertical. Type species *Rallus hodgeni* Scarlett. (Described from pelvis 5803 from Pyramid Valley in Canterbury Museum.)

In the depressed upper borders of the ilia this pelvis agrees with those of small gallinules, such as *Gallinula* and *Tribonyx,* and with coots, but it differs from coots in its short postacetabular portion. It differs from the larger gallinules, such as *Porphyrio* and *Notornis,* and from rails, in the depressed upper borders of the ilia. It is therefore a small gallinule. From *Gallinula* it differs in



Chatham Islands *Dominion Museum*

DIAPHORAPTERYX HAWKINSI

the more arched iliac crest, wider ilia, concave instead of convex anterior upper borders of ilia, and steeper upper surface of the postacetabular portion of the pelvis. From *Tribonyx* it differs in the deeper depressions in the upper iliac borders and the steeper upper surface of the postacetabular portion of the pelvis. Apparently *Pyramida* is closely allied to *Tribonyx.*

New Zealand Gallinule
Pyramidia hodgeni

Several bones, but no skull, of this small gallinule were discovered in Pyramid Valley swamp during the last few years by R. J. Scarlett and others. Scarlett selected a pelvis as type specimen and described the species under the name *Rallus hodgeni,* naming it after Messrs. J. and R. Hodgen, owners of the swamp and who permit the Canterbury Museum to carry out excavations there for collecting moa and other bird bones.

Pelvis length 54-58, least width 10-11, width at antitrochanters 24-26 mm. Humerus length 40, femur 55-58, tibia 73-74, metatarsus 42 mm. Type pelvis, no. 6197, in Canterbury Museum.

In the tibiae assigned to this species the entocnemial crests are oblong, very large, and project forwards and upwards from the upper ends of the shafts. These crests are continuous as hoods with the ectocnemial crests well above the articular surfaces for the femora. The fibular ridges are rather high especially in their lower portions and their edges are roughened and thickened throughout.

Distribution. Pyramid Valley swamp, Glenmark swamp, Lake Grassmere sand dunes.

Reference.—Scarlett, Rec. Cant. Mus., 6, 265, 1955 (*Rallus hodgeni,* Pyramid Valley).

Extinct Takahe
Notornis mantelli

This species, and with it the genus Notornis, was founded by Owen on a skull collected by W. B. D. Mantell, at Waingongoro, in the North Island, in 1847.

The skull is readily distinguished from that of the recent *Notornis hochstetteri* by the greater width between the temporal fossae. It differs from Porphyrio in the almost rectangular figure of the cranium when viewed from above, due to the breadth of the anterior part being almost the same as the occipital region.

Length of skull 103, breadth between temporal ridges 16-24 mm.

Distribution. North Island: Waingongoro, Martinborough, Coonoor Cave.

References.—Owen, Trans. Zool. Soc. 3, 366, 1848 (*Notornis mantelli,* Waingongoro); Extinct Birds N.Z., 173, pl. 47, 1879. Rothschild, Extinct Birds, 141, 1907.

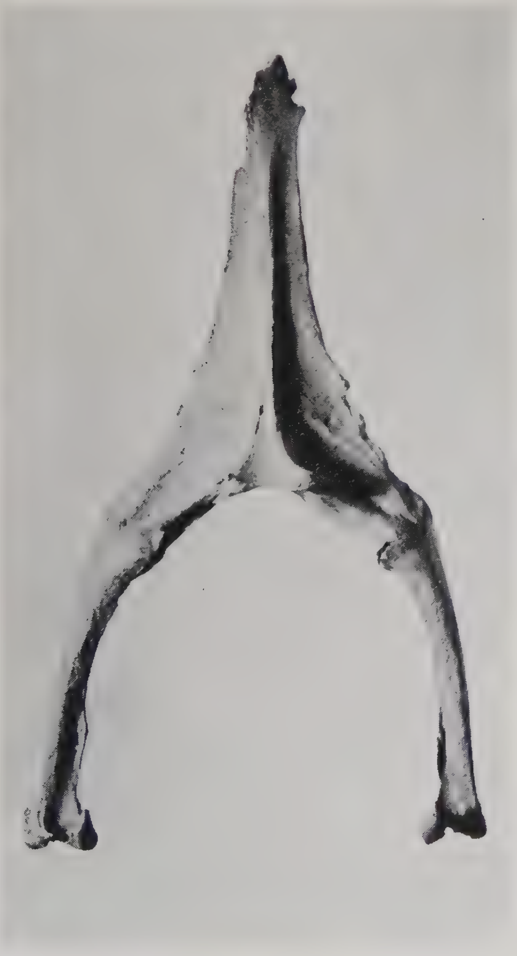
FAMILY APTORNITHIDAE
GENUS APTORNIS

Skull massive with thick cranial walls, upper margins of orbits thickened and rugose, cranium from above hexagonal, the post-orbital processes being prominent. Beak stout, long, swollen in the middle, sharp pointed, both mandibles decurved, their cutting edges thickened and rugose. Temporal fossae deep but intertemporal space wide. Nasal septum complicated. Nasal opening rounded in front where it is widest. Lacrymals notched into the frontals, outer surfaces facing forwards as in the moas. Basioccipital produced downwards and, with the basisphenoid, forming an almost vertical plate below the occipital condyle. Vomer ending in a thin vertical plate, truncate and denticulate in front, deeply grooved above. Quadrate with lower surface, including the articular facet for the mandible, a broad platform. Mandible with symphysis one third its length and deeply hollowed above; a broad flattened articular surface for the quadrate.

Sternum elongate, triangular, front and sides concave; precostal processes produced with the coracoids fused to their ends; keel a low ridge broadening into a triangular area in front.

Pelvis with the iliac ridge in front of the acetabula arched; post-actetabular portion shorter and sloping steeply backwards; escutcheon roughly hexagonal, the anterior edges diverging about 130 degrees from the iliac crest.

Aptornis is a very specialized bird departing far from the generalized type of rails like the banded rail and the wekas. It has some features, such as the vomer, hexagonal cranium and the long curved beak, that recall *Diaphorapteryx,* and no doubt the two forms are derived from related stocks, *Aptornis* diverging most from their common ancestor. The small wing bones show that it was incapable of flight. Two species have been defined, the South Island *A. defossor* being the larger.



Pyramid Valley *F. McGregor*

STERNUM and CORACOIDS of APTORNIS DEFOSSOR

Reference.—Owen, Trans. Zool. Soc. 3, 347, 1848 (*Aptornis,* type *Dinornis otidiformis,* Owen); Extinct Birds, N.Z., 181, 1879. Lowe, Ibis, 1926, p. 175. Oliver, Emu, 45, 131, 1945.

Greater Aptornis

Aptornis defossor

This species was discovered in a cave near Oamaru in 1863, by the Rev. Richard Taylor, who took the bones, including a skull, to England and handed them to Professor Owen for description. In 1892, Mr. A. Hamilton carefully investigated the caves at Castle Rocks and procured a good series of bones of this species.

Skull with deep temporal fossae, and a strongly marked prominence on the supraoccipital above the foramen magnum. Coracoids anchylosed to sternum. Length of skull 182, pelvis 280, sternum 147, femur 190, tibia 278, metatarsus 118 mm.

Distribution. South Island: Oamaru, Oreti River, Kapua, Glenmark, Redcliffs, Timaru, Takaka, Lake Grassmere, Pyramid Valley, Herbert, Ngapara, Castle Rocks, Forest Hill, Lime Hills.

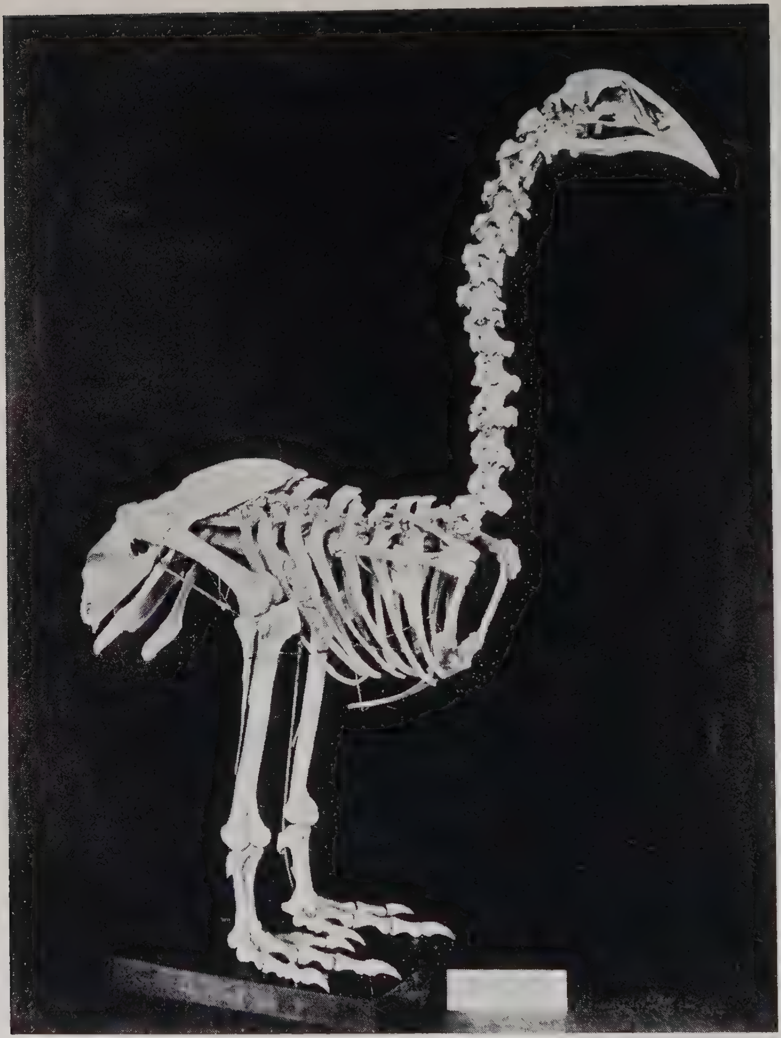
References.—Owen, Trans. Zool. Soc. 7, 354, 1871 (*A. defossor,* Oamaru); Extinct Birds, N.Z., pp. 290, 339, 1879. Lydekker, Cat. Foss. Birds, Br. Mus., 152, 1891. Hamilton, Trans. N.Z. Inst., 24, 176, 1892. Oliver, Emu, 45, 131, 1945.

Lesser Aptornis

Aptornis otidiformis

When visiting the East Cape District about 1840, the Rev. W. Williams collected a number of bones mostly belonging to species of moa, but included was a tibio-tarsus which Owen described as a new species of Dinornis. On account of being similar in size to the great bustard he named it *D. otidiformis.* Numerous specimens were later collected by W. B. D. Mantell at Waingongoro and the true affinities of the species determined.

Skull with the temporal fossae of median depth and the middle line of the supraoccipital not forming a distinct prominence.



Castle Rocks *British Museum*

APTORNIS DEFOSSOR

Coracoids distinct from sternum. Length of skull 165, femur 156, tibia 225, metatarsus 97 mm.

Distribution. North Island: East Cape, Waingongoro, Wanganui, Martinborough, Coonoor.

References.—Owen, Trans. Zool. Soc. 3, 247, 1844 (*Dinornis otidiformis,* East Cape); Extinct Birds N.Z., pp. 85, 179, 185, 303, 1879. Lydekker, Cat. Foss. Birds Br. Mus. 147, 1891.

FAMILY FULICIDAE

GENUS PALAEOLIMNAS

Differs from Fulica in the more curved form of the skull, the deeply marked glandular impressions over the orbits, and the pronounced pneumaticity of the frontals. The keel of the sternum is reduced as compared with living coots. South Island and Chatham Islands. Although the bones from these localities were described as distinct species the differences are not more than would be expected in a single species.

Reference.—Forbes, Ibis, 1893, p. 544 (*Palaeolimnas*, type *P. chathamensis* Forbes).

New Zealand Coot

Palaeolimnas chathamensis

This species was discovered by H. O. Forbes in the Chatham Islands in 1892. Forbes compared it with *Fulica newtoni* of Mauritius finally deciding that it was identical, but Milne-Edwards pointed out several differences. Mr. A. Hamilton, when investigating the avian remains at Castle Rocks in 1892, found many bones of this coot.

Skull, length 90, postorbital breadth 28 mm.; mandible, length 74 mm.; sternum, length midline 77, width at precostal processes 43.5 mm.; humerus, length 100 mm.; femur, length 78-90 mm.; tibia, length 144-166 mm.; metatarsus, length 82-96 mm.

Distribution. Takaka, Lake Grassmere, Pyramid Valley, Castle Rocks, Kapua, Ngapara, Chatham Islands.

References.—Forbes, Nature, 46, 252, 1892 (*Fulica chathamensis,* Chatham Is.) Milne-Edwards. Ann. Sci. Nat. (8). 2. 130. 1896. Rothschild. Extinct Birds. 149. 1907. Hamilton. Trans. N.Z. Inst., 25, 98 1893 (*Fulica prisca,* Castle Rocks).

FAMILY ANATIDAE

GENUS PACHYANAS N. GEN.

Skull heavily built with stout lacrymals and postorbital processes. Supraorbital depressions deep and extensive, the inner margins separated by a central ridge. Lacrymals large, with a long anterior portion fused to the frontals; descending processes thick, sloping backwards and downwards and expanded into rounded terminal portions. Back of skull with oblong depressions bounded on the outside by incurved nearly vertical ridges, the depressions extending far above the supraoccipital foramina. Supraoccipital ridge projecting well posterior to the occipital condyle. Type species *P. chathamica* n. sp.

This robust skull differs from all skulls of ducks and geese with which I have compared it in the very short, thick, descending processes of the lacrymals. The long anterior limb of the lacrymals separates it from geese and allies it to ducks. On the other hand the wide and deep supraorbital depressions remind one of *Cereopsis.* Without the maxillary region it is difficult to determine the true position of this duck.

Chatham Island Duck

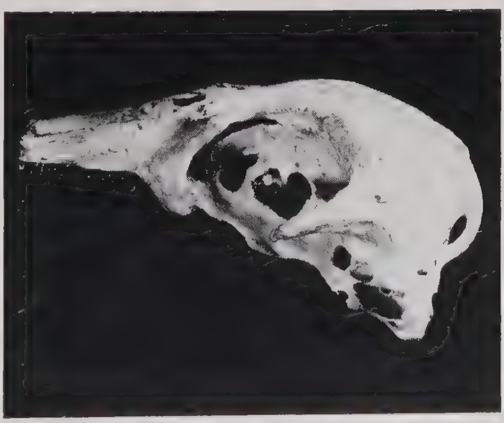
Pachyanas chathamica n. sp.

The collection of bird bones from the Chatham Islands in the Canterbury Museum includes a cranium, several pelves and a number of leg and wing bones of the stoutly built duck here described.

Cranium length to lacrymal nasal junction 62, postorbital width 33, lacrymal peduncle 4, terminal portion 7 mm. Pelvis with prominent antitrochanters behind which the ilia are wide apart and parallel; ischia spreading, the posterior portion descending and curving forwards at the ends. Pelvis length along central line 89-96, least width 17-21, width at antitrochanters 42-47.5, width at posterior ends of ischia 56-63 mm. Humerus length 95, femur 67, tibia 101.5, metatarsus 58.5 mm.

The cranium is the type of the species.

Distribution. Chatham Islands.



Chatham Islands *F. McGregor*

SKULL OF PACHYANAS CHATHAMICA

Chatham Islands *F. McGregor*

SKULL OF PACHYANAS CHATHAMICA

Reference.—Milne-Edwards, Ann. Sci. Nat., 8th Ser. Zool., 1, 126, pl. XI-XII, 1895 (pelvis, as *Diaphorapteryx*).

Genus Euryanas

A small extinct duck with short bill and stout leg bones. Bill to naso-frontal suture about 42 per cent. of length of skull, a little wider at base but anterior portion with parallel sides; the pointed posterior ends of the maxillary processes of the premaxilla are well in front of the naso-frontal suture. Lacrymal with a long forward extension and a rather narrow downward portion widening a little at the end. Metatarsus less than three-fourths the length of the skull.

Compared with *Chenonetta, Euryanas* has the premaxilla very slightly longer in proportion to skull length; wider sternum with processes at wider angles; pelvis proportionately wider, with ileo-ischiadic foramen larger and junction of ilia and ischium broader and longer; leg bones much stouter. *Euryanas* differs from *Pachyanas* in the shallower occipital depressions, the long narrow downward limb of the lacrymals, the absence of defined supraorbital depressions and its lighter build.

Reference.—Oliver, N.Z. Birds, 220, 1930 (*Euryanas*, type *Anas finschi* van Beneden).

Extinct New Zealand Duck

Euryanas finschi

The Earnscleugh Cave was accidentally discovered by a lad named Weir, about 1870, and was shortly afterwards explored by Mr. Arthur, surveyor, and Dr. Thomson of Clyde, who collected a large number of birds' bones. Among them were bones of an extinct species of duck which were forwarded to Dr. O. Finsch, of Bremen, who in turn handed them to Professor Van Beneden for description.

Skull, length 78, beak from nasal suture 34, width of beak 14, post orbital width of skull 28 mm.

Sternum, length 76, width at costal processes 45; humerus, length 85, femur 68, tibia 102, metatarsus 52 mm.

Pelvis, length along middle line 87, width at posterior end of ischia 60 mm.

Distribution. South Island: Earnscleugh Cave, Castle Rocks, Ngapara, Lake Grassmere, Pyramid Valley, Pareora.

References.—Van Beneden, Jour. Zool., 4, 267, 1875 (*Anas finschi,* Earnscleugh); Trans. N.Z. Inst., 9, 599, 1877 (abstract). Hamilton, Trans. N.Z. Inst., 25, 106, 1893.

Genus Malacorhynchus

Bill longer than the head, expanded anteriorly (in life with long wing like appendages). The prexamilla is not unlike that of *Spatula* though the colour of the plumage of these two ducks is very dissimilar.

Reference.—Swainson, Jour. Roy. Inst., 2, 18, 1831 (*Malacorhynchus,* type *Anas membranacea* Lath.).

Pink-eared Duck

Malacorhynchus membranacea (?)

Only the terminal fragments of the premaxillae of two individuals were found by R. A. Falla in the swamp at Pyramid Valley and it cannot be determined for certain whether or not they belong to the same species as the pink-eared duck of Australia, but as the Pyramid deposits are recent in a geological sense probably the remains found there belong to the Australian species.

Distribution. Pyramid Valley, North Canterbury.

Reference.—Falla, Rec. Cant. Mus., 4, 352, 1941.

GENUS CEREOPSIS

A depression between the nasal portion and the tip of the premaxilla. Posterior end of maxillary process of premaxilla sheared forward from upper to lower border, not projecting backwards of junction with maxilla. Lacrymal sloping away from frontal-nasal junction; posterior longer than anterior limb; descending process very long sometimes united with postorbital process. Supraorbital depressions large, shallow, approaching closely in the mid line.

Cereopsis resembles *Cnemiornis* in the form of the premaxilla but differs in the shape and size of the supraorbital depressions. In *Cereopsis* the lacrymals are triradiate, in *Cnemiornis* they are elongated without transverse processes. The sternum and pelvis are considerably different in the two genera.

Reference.—Latham. Ind. Orn. Suppl., 67, 1801 (*Cereopsis*, type *C. novae hollandiae*).

New Zealand Cape Barren Goose

Cereopsis novaezealandiae

A portion of a cranium was named but insufficiently described by H. O. Forbes in 1892. In the Dominion Museum is a skull, without mandible, which enables me to define the New Zealand bird.

Skull as in *C. novae hollandiae* but a little longer and a little narrower thus making it proportionately more slender. The New Zealand skull has a length of 99 mm. and a breadth at the base of the postorbital processes of 33.5 mm., the corresponding measurements taken from Owen's illustrations of the Australian *c. novae hollandiae* being 93 and 34 mm. The proportion of width to length (taken as 100) is 34 in the New Zealand bird and 36.5 in Owen's figure. Schufeldt gives a photograph showing a skull which apparently is still broader in proportion to the length. The premaxilla of the New Zealand specimen has a length of 47 mm. and a breadth of 23 mm. compared with 43 and 25 mm. in Owen's figure. The palatal surface shows more slender palatines and a narrower space between the basipterygoid processes than in the Australian bird. Postorbital processes slender, sharp pointed. Descending processes of lacrymals narrow, pointed. The postorbital and lacrymal processes do not curve towards each other and sometimes meet as in Australian birds.

Distribution. New Zealand. Locality unknown.

References.—Forbes, Trans. N.Z. Inst., 24, 188, 1892 (*C. novae-zealandiae*). Owen, Trans. Zool. Soc., 9, 253, 1875 (Extinct Wingless Birds N.Z., 365, 1879). Schufeldt, Emu, 12, 211, 1913.

GENUS CNEMIORNIS

Large extinct flightless geese, the height of the larger species being about three feet.

Skull with nasal portion shorter than cranial; beak short, wide, truncate at tip; a depression between the nasal region and the tip of the premaxilla; posterior end of maxillary process of premaxilla sheared forwards from upper to lower border, not projecting backwards of maxillary junction. Lacrymals elongate, widest at upper end, truncate in front but slightly produced behind. Supraorbital depressions rather small, widely sundered in the mid line and separated from the orbital borders by considerable spaces. The palatines are widest in front, narrowed in the middle and widened posteriorly to parallel sided bars; the ascending processes are juxtaposed vertical plates and, according to Hector, are firmly united to the vomer. Lower mandible broad, little diverging, symphysis broad, almost rectangular, anterior half flat, posterior excavated.

Pelvis with short and high preacetabular portion; ilium and ischium united behind a large pyriform foramen, pubic styles narrow, widening posteriorly and probably united by cartilage to ischia.

Sternum oblong, slightly wider in front than behind; anterior margin with median and two lateral emarginations; coracoid grooves widely separated; keel very low, expanded in front and extending backwards for less than half the length of the sternum.

Ulna shorter than humerus with prominent tubercles for the secondaries. Cnemial crest of tibio-tarsus greatly developed.

The nearest ally of Cnemiornis is the Cape Barren Goose of Australia and Tasmania (*Cereopsis novae-hollandie*). This species has, beside other features, a well-developed sternal keel and the wing is relatively larger than in *Cnemiornis.* The premaxilla of *Cnemiornis* closely resembles that of *Cereopsis* but the lacrymals, supraorbital depressions, sternum and pelvis are considerably different.

Reference.—Owen, Trans. Zool. Soc., 5, 396, 1865 (*Cnemiornis,* type *C. calcitrans,* Owen).

South Island Extinct Goose

Cnemiornis calcitrans

The bones of this large goose were first discovered in a crevice in limestone rocks near Timaru about 1863 and were transmitted to Professor Owen for description. A few years later, a number of bones were collected by Captain Fraser in the Earnscleugh Cave and these were fully described by Dr. Hector in 1874.

Skull length 120, breadth across base of postorbitals 51, length of beak from nasal-frontal suture 54 mm. Sternum length 180, breadth across precostal processes 114 mm. Pelvis total length 300, along middle line 225, breadth at posterior end of ischia 110 mm. Humerus 157, femur 160, tibia 307, metatarsus 142 mm. in length.

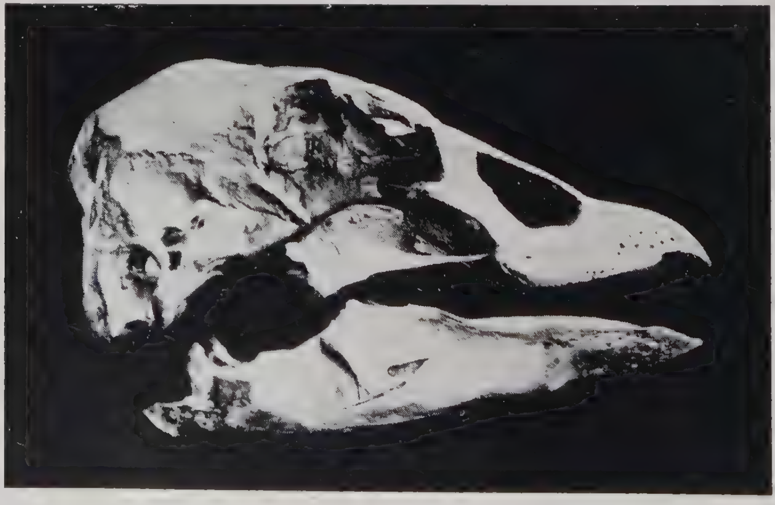
Distribution. Glenmark, Pyramid Valley, Timaru, Earnscleugh Cave, Kapua, Enfield, Hamilton Swamp, Dunstan, Herbert.

References.—Owen, Trans. Zool. Soc., 5, 396. 1865 (*Cnemiornis calcitrans,* Timaru); 9, 253, 1875; Ext. Birds N.Z., pp. 338, 365, 1879. Hector, Trans. N.Z. Inst., 6, 76, 1874. Oliver, N.Z. Birds, 231, 1930; Emu, 45, 125, 1945. Lydekker, Cat. Foss. Birds Br. Mus., 99, 1891.

North Island Extinct Goose

Cnemiornis septentrionalis n. sj.

The first bones of Cnemiornis collected in the North Island seem to be those obtained by S. H. Drew, curator of the Wanganui Museum, from brown sands at Kaiiwi in 1886. When excavating a swamp at Te Aute in 1888 A. Hamilton collected bones of this species among large numbers of moa bones, and in 1896 J. S. Stewart found others in a railway cutting at Hunterville. The bones from Kaiiwi and Hunterville are in the Wanganui Museum.



F. McGregor (from a photograph)

SKULL OF PACHYANAS CHATHAMICA

This species is considerably smaller than *C. calcitrans,* the size averaging about three-fourths of that species. Humerus length 126 mm. Femur length 120 mm. Tibia length 230, width at top 55, at centre of shaft 14.5, at bottom 28 mm. Metatarsus length 120 mm. The metatarsus is from Kaiiwi, the other bones from Hunterville. The tibia is the type specimen.

Distribution. Kaiiwi, Hunterville, Napier, Te Aute.

Chatham Island Swan

Cygnus chathamicus n. sp.

A species of swan considerably larger than the Australian black swan formerly existed in New Zealand and the Chatham Islands. It was discovered by H. O. Forbes at the Chatham Islands in 1892. Forbes remarks that it must have been enormously common at Wharekauri (Chatham Islands). Forbes gave the name *sumnerensis,* without description, to three coracoids and the proximal and distal ends of a humerus of a swan from Moncks Cave near Sumner. As these bones cannot now be identified Forbes' name should be abandoned. The name I now propose is based on a composite skeleton in the Dominion Museum from the Chatham Islands. The skull is the type specimen.

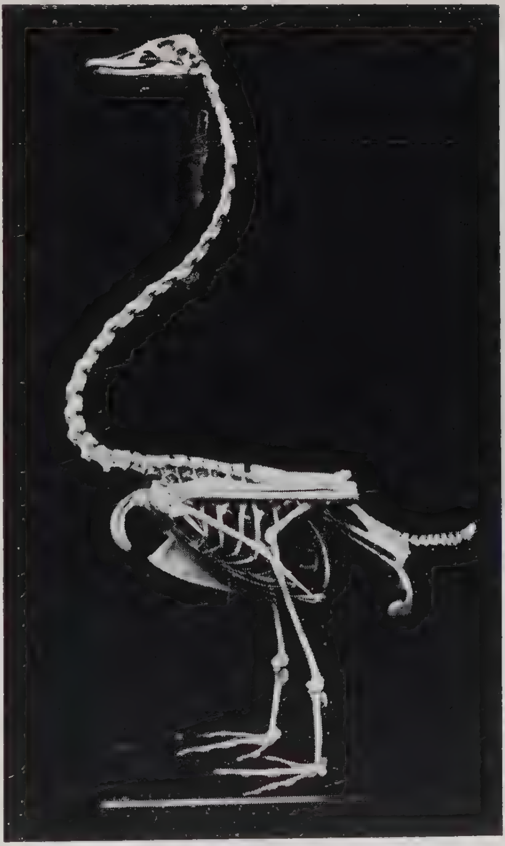
Premaxilla wide and bulbous in front. Lacrymal with broad upper horizontal portion and broad descending process backwardly directed and slightly widening in its lower half. Posterior ends of premaxilla well in advance of posterior ends of maxillo-palatines. Septum in nasal chamber with horizontal expansions. Supraorbital depressions broad and shallow, continuous across the mid line. Occipital and temporal depressions in contact. Vomer a vertical plate with narrow flanges at top. Backward extentions of mandible narrow and upturned.

Sternum with lateral processes projecting beyond xiphisternal border. Pelvis with narrow notch between posterior borders of ilium and ischium; posterior ends of pubic styles expanded and upturned forwards.

Skull, length 147, post-orbital width 43, nasal suture to tip 73, width of premaxilla 29 mm. Mandible, length 138 mm. Sternum, length 173, width at precostal processes 94 mm. Pelvis, length along mid line 220, width across ends of pubes 100 mm. Length of humerus 263, ulna 243, femur 100, tibia 205, metatarsus 116 mm.

Distribution. Chatham Islands. New Zealand: Te Aute, Wairau Bar, Lake Grassmere, Warrington.

Reference.—Oliver, N.Z. Birds, 232, 1930 (*Chenopsis sumnerensis*).



Chatham Islands *Dominion Museum*

CYGNUS CHATHAMICUS

FAMILY FALCONIDAE

GENUS HARPAGORNIS

Large extinct eagles with very strong legs but comparatively short wings.

Skull long with a deep powerful beak decurved at the tip and with the cutting edge sinuate. Cranium abruptly widening behind orbits; temporal fossae large and shallow, the ridges confluent with the lambdoidal ridges. Mandible rather narrow, symphysis channelled.

Sternum with deeply convex body and high rounded keel; coracoid grooves meeting in front, precostals small; six costal articular surfaces; xiphisternal border with a shallow notch and a foramen (often incomplete) on each side.

Pelvis with ilia united above but diverging in front and behind; ischia strongly developed and expanded, pointed posteriorly.

Harpagornis is closely allied to the recent genus Haliaetus. Its distinctive features are the narrow skull, short ulna and stout metatarsus.

There are two species differing in little but size. It has been suggested that the smaller one is the male and the larger one the female of the same species.

Reference.—Haast, Trans. N.Z. Inst., 4, 193, 1872 (*Harpagornis,* type *H. moorei* Haast).

Greater Extinct Eagle

Harpagornis moorei

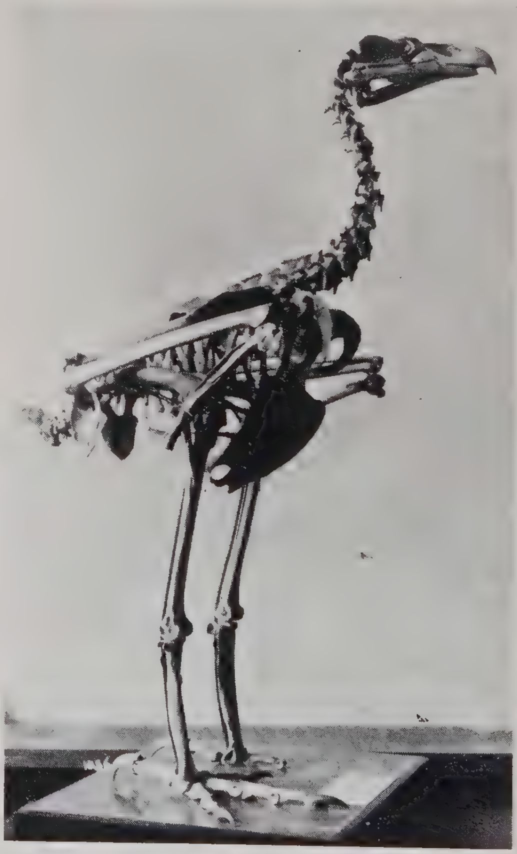
The first discovered bones of this species were found in 1871 when the moa deposits of Glenmark were being investigated by Haast. The genus and species were founded on a femur. Haast later found more bones in the same locality and, in 1880, in the Hamilton Swamp. In 1892, A. Hamilton found a nearly perfect skull at Castle Rocks.

Femur. Type from Glenmark. Shaft bent forwards; hollow on top of head large; trochanteric ridge well developed, roughened; inter muscular linear ridges raised; proximal pneumatic orifice large and ear-shaped.

Skull, length 166, breadth 76, sternum length 162, breadth 90; pelvis length 200, breadth across ischia 92; humerus, length 210, ulna 255; femur 170, tibia 249; metatarsus 156 mm.

Distribution. Te Aute, Wairau Bar, Lake Grassmere, Pyramid Valley, Banks Peninsula. Glenmark, Hamilton Swamp, Enfield, Dunstan, Castle Rocks.

References.—Haast, Trans. N.Z. Inst., 4, 192, 1872 (*Harpagornis moorei,* Glenmark); 6, 62, 1874. Hamilton, Trans. N.Z. Inst., 25, 92, 1893. Owen, Extinct Birds N.Z., 141, 1879. Rothschild, Ext. Birds, 85, 1907.



Castle Rocks *Otago Museum*

GREATER EXTINCT EAGLE

Lesser Extinct Eagle

Harpagornis assimilis

This smaller species of eagle, or, it may be, the male of *H. moorei,* was discovered by Haast at Glenmark, associated with the larger form, in 1873. The original specimen consisted of a portion of a skeleton.

Skull: length of mandible 126; humerus, length 218; ulna 237; femur 155; tibia 227; metatarsus 150 mm.

Distribution. Glenmark, Hamilton Swamp, Lake Grassmere, Castle Rocks, Motunau, Warrington, Kapua, Waingongoro, Pyramid Valley.

References.—Haast, Trans. N.Z. Inst., 6, 64, 1874 (*Harpagornis assimilis* Glenmark); 13, 232, 1881. Hamilton, Trans. N.Z. Inst., 25, 92, 1893; 26, 227, 1894.

Large Extinct Harrier

Circus eylesi

Semifossil bones of a harrier larger than the common one (*C. approximans*) have been found in New Zealand from time to time. Forbes in 1892 named, but did not describe, what he thought to be two species. When the Pyramid Valley swamp was being excavated for moa bones, from 1939 onwards, a good series of harrier bones was found and these were described by R. J. Scarlett as a new species under the above name.

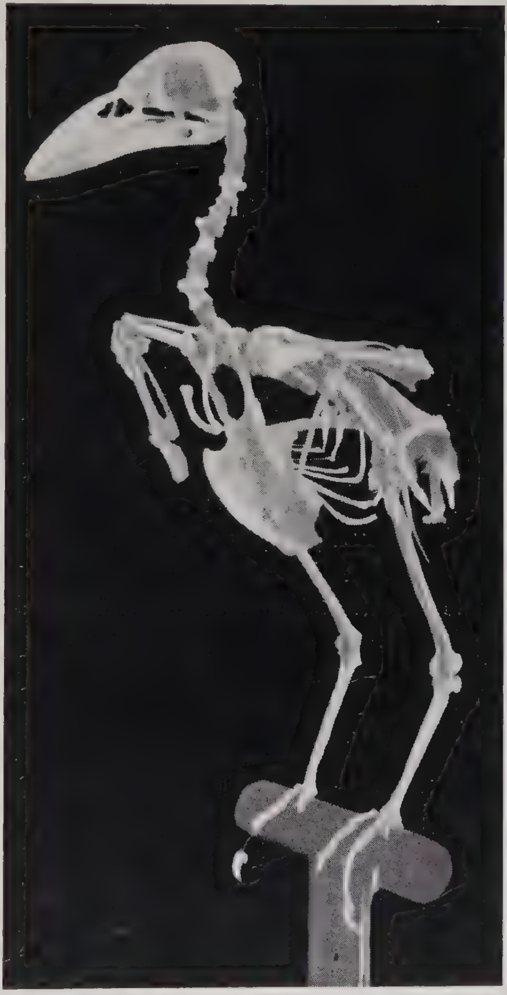
Skull: Posterior slope of cranium not so steep as in *C. approximans,* cutting edge of premaxilla convex; outer sides of posterior ends of palatines bevelled (not nearly truncate as in *C. approximans*). Sternum widening posteriorly and not emarginate behind. Pelvis: Ilia in front almost covering the first dorso-lumbar vertebra; in post-acetabular region more widely divergent than in *C. approximans.*

Cranium length 80, width 45 mm. Sternum length 83, breadth 49 mm. Pelvis length 79, breadth 49 mm. Humerus length 121; femur 96; tibia 143; metatarsus 113 mm.

This species is larger than *C. approximans* and otherwise well distinguished by the characters given above.

Distribution. Pyramid Valley. Lake Grassmere.

Reference.—Scarlett, Rec. Cant. Mus., 6, 245, 1953 (*Circus eylesi,* Pyramid Valley).



PALAEOCORAX MORIORUM

FAMILY CORVIDAE. CROWS

Premaxilla more or less triangular in cross section, narial openings oval, about one fourth the length of the beak; lacrymals and ectethmoids usually fused into a transverse plate.

GENUS PALAEOCORAX

Beak stout, premaxilla arched above and slightly downcurved along the cutting edge. Vomer with the anterior part widened and ending in three blunt points, the outer ones being broad septomaxillaries fused with the vomer. Roof of palate forming a floor to the nasal chamber reaching almost to the vomer. Maxillo-palatines with wide peduncles continuous in front on either side with the palate. Lacrymal and ectethmoid fused into a plate with a sharp point on the outer lower corner. Nasal septum ossified with its posterior end lodged in the concavity of the upper surface of the vomer.

The skull is very similar to that of Corvus except for the shape of the vomer and the maxillo-palatines and the extra ossification on the roof of the palate under the nasal chamber. It has not the solid beak with small nasal openings and fused prevomarine region of Gymnorhina (Family Streperidae).

Reference.—Forbes, Ibis, 1893, p. 254 (*Palaeocorax*, type *Corvus moriorum* Forbes).

Extinct New Zealand Crow

Palaeocorax moriorum

This extinct crow, of which a good many bones have been collected, was first discovered at the Chatham Islands by H. O. Forbes. Specimens subsequently collected in New Zealand were said by Forbes to belong to two species, one smaller than the other but no descriptions have been published.

Skull, length 114, nasal suture to tip of bill 74, postorbital width of cranium 47 mm.

Humerus 83, ulna 98, femur 70, tibia 116, metatarsus 71 mm. in length.

Distribution. North Island. South Island. Wairau Bar, Lake Grassmere, Pyramid Valley, Banks Peninsula, Ngapara. Chatham Islands.

Reference.—Forbes, Nature, 46, 252, 1892 (*Corvus moriorum*, Chatham Islands).

INTRODUCED BIRDS

FAMILY ANATIDAE

Cape Barren Goose

Cereopsis novaehollandiae

Two early attempts to establish the Cape Barren Goose in New Zealand were unsuccessful. In 1912 the Otago Acclimatisation Society received two birds and from the progeny of these, four were liberated at the head of Lake Hawea in 1915. In 1936 Cape Barren Geese were reported on Lake Hawea and Lake Thompson.

Adult. Upper surface brownish grey, the feathers margined with paler; forehead and crown much lighter; some of the feathers of the shoulders and wing coverts with a brownish black spot near their tips; tail, under tail coverts and ends of primaries blackish brown. Under surface brownish grey. Bill black. Cere very large, lemon yellow. Iris light buff. Eyelids dark brown. Feet reddish orange, toes, webs, claws and streak in front of tarsus black. Bill 50, wing 510, tail 200, tarsus 90 mm. *Nestling.* Upper surface and sides of head brown; a broad white band on each side of the head and another on each side of the back. Throat white, remainder of under surface whitish grey.

Eggs. Clutch four to six, elliptical with both ends rather pointed, white, glossy with thin limy coating. 88 x 57, 90 x 60 mm. Tasmania.

Distribution. Lake Hawea, Lake Thompson. South-west Australia, South Australia, Victoria, islands of Bass Strait, Tasmania.

Habits. In Australia the Cape Barren Goose does not go far inland. Its food is grass and herbs of which it eats large quantities. Sheep will not graze in pastures that have been browsed on by Cape Barren Geese. Its voice is a grunt and hence the name Pig Goose is sometimes applied to it. It usually nests on islands off the coast. The nest is placed on the ground or on a dense low bush. It is composed of grass and lined with down. The species is now becoming rare.

References.—Latham, Ind. Orn. Suppl., 67, 1801 (*Cereopsis novaehollandiae* [Victoria]). Shufeldt, Emu, 12, 211, 1913 (skeleton).

Canada Goose

Branta canadensis canadensis

Various importations of the Canada Goose have been made into New Zealand since 1876 when three were landed in Wellington. They have become firmly established in several localities in Canterbury and Otago. The birds released in the North Island failed to establish themselves.

Adult. Head and neck black, chin and throat white extending upwards on the cheeks and ending in a point behind the ear coverts; back, wing coverts and secondaries brown, the feathers (except on the back) with pale edges; rump black; upper tail coverts white; primaries and tail black. Lower part of neck white; breast and abdomen pale brown, fading to white on under tail coverts. Bill black. Iris dark brown. Feet dark lead-colour. Bill 57, wing 500, tarsus 90 mm. *Nestling.* Crown olive; back, rump, wings and flanks yellowish olive; remainder yellowish shading to primrose yellow on the throat and abdomen, and buff on the breast. Bill black.

Eggs. Clutch five to seven, elliptical, creamy white. 81 x 56.4, 84 x 57.4 mm. Canterbury.

Distribution. Recently Canada Geese have been seen at Miranda, Lake Rotorua, Marton and Levin, no doubt stragglers from the South Island. Plentiful at Lakes Rotoroa, Guyon, Heron, Hawea, Wanaka and others, and along several rivers in Canterbury and Otago. In winter, according to E. B. Davison since 1952, Canada Geese collect on

Mackenzie Country *K. V. Bigwood*

CANADA GEESE

Lake Ellesmere. About 5,000 birds arrive late in January and early in February. They return to their breeding grounds in September. The seasonal range of the Canada Goose is thus much shorter than it is in the homeland of the species, North America.

North America, breeding in Canada and Northern United States; in winter migrating as far south as Mexico.

Habits. A short account of the habits of the Canada Goose in New Zealand is given by Thomson. He states that it nests in October in swamps and near streams in a depression in dry grass, sedges or rushes. The young begin to fly about the middle of January. In winter the Canada Geese gather into flocks and come out into the cultivated country. It is difficult to approach them as several in a flock keep guard. When feeding they crop the grass very closely. Their flight is exceedingly rapid and the note sounded on the wing is a trumpet-like honk.

Ecology. In some places Canada Geese increased to such an extent as to become a nuisance because sheep and cattle will not graze where the geese have been feeding. In North Canterbury where they became a serious menace to pastures Government officers killed many thousands at the time the birds were moulting and unable to fly. They could then be driven from the lakes and pursued on land.

References.—Linne, Syst. Nat., ed. X, 123, 1758 (*Anas canadensis,* Canada). Thomson, Nat. Anim. Plants N.Z., 104, 1922; Wild Life N.Z., pt. II, 8, 1926.

Mute Swan

Cygnus olor

The Mute Swan is not properly naturalized in New Zealand though in several localities it holds its own in very small numbers, in some places only a pair. It was liberated, two or more at a time, in Christchurch, 1866, Auckland, 1867, Dunedin, 1868.

Adult. A prominent knob at the base of the culmen. Entire plumage white. Bill reddish orange, the base, nail, nostrils and cutting edges of both mandibles black. Lores and knob on bill black. Feet black. Bill 107, wing 685, tail 254, tarsus 114, mid toe 165 mm. *Immature* without knob on bill; plumage sooty grey, paler on the neck and under surface. *Nestling* covered with ashy grey down.

Eggs. Clutch three to nine or ten, creamy white, length 109 x 72 mm. Riccarton. 111 x 75 mm. Lake Ellesmere.

Distribution. Pupuke Lake, Foxton, Ashley mouth, Kaituna, Akaroa, Tomahawk, Lake Waihola, and some other places. Few only in each locality.

Europe and Asia; wintering in North Africa, Black Sea, India and Korea.

Habits. The food of the Mute Swan consists principally of aquatic plants, but molluscs, insects, frogs and small fish are occasionally eaten. The Mute Swan has a trumpet-like note but seldom utters it. The nest is a large structure of reeds and grass sometimes five feet across and two feet high. When guarding the nest the male swan is very savage and will attack intruders with bill and feet. In New Zealand a child was reported to have been dragged into a pond and drowned by a white swan.

Reference.—Gmelin, Syst. Nat., 1, 501, 1789 (*Anas olor,* Russia).

Black Swan

Cygnus atratus

The first importation of the Black Swan into New Zealand consisted of seven birds landed at Nelson some time prior to 1864. Since that time several other shipments have arrived. From New Zealand Black Swans were taken to the Chatham Islands by L. W. Hood. Everywhere the species quickly established itself and spread far and wide.

Adult. Brownish black, the under surface paler than the upper; feathers of back tipped with greyish brown; primaries and secondaries white. Scapulars and inner secondaries crisp. Bill scarlet, crossed near the tip with a broad white band, tip white. Iris scarlet. Eyelash and lores scarlet. Feet black. Bill 70, wing 480, tail 170, tarsus 90, mid toe 128 mm. *Immature* similar to adult but plumage and bill duller, and feathers on back with pale margins. *Nestling.* Upper surface light brownish grey, lores brownish black, under surface white. Bill brownish black, nail white. Feet greyish brown. Later the under surface becomes greyish. *Colour Varieties.* A partial albino was observed at Tomahawk Bay. A specimen obtained near Christchurch was light brown and fawn due to the feathers being brown with fawn borders; the white parts as in normal birds.

Eggs. Clutch four to seven, elliptical, greenish white, 111 x 68 mm. Lake Ellesmere. 108 x 70 mm. Chatham Islands.

Distribution. North, South and Chatham Islands. Abundant throughout. On lagoons and lakes near the coast, especially large numbers being found in the Kaipara district, Wairoa, Lake Wairarapa, Wairau mouth, Lake Ellesmere, Washdyke and the Chatham Islands. A few pairs nesting at Lake Waikaremoana. Small numbers in the Fiordland region (Doubtful Sound, Caswell Sound, Lake Hauroko), and Stewart Island. There are seasonal movements to tidal estuaries in the winter, many visiting Manukau Harbour.

Australia. Tasmania.

Ecology. The larger lagoons near the coast are favoured by the Black Swan. On these it has room when alarmed to keep some distance off shore. It feeds near the shore mainly on aquatic plants which it can reach at greater depths than can ducks. By thus starving the ducks, and also by fouling the water and shore, it causes both ducks and pukeko to leave. This has been evident at the Chatham Islands where it is ousting the ducks from the great lagoon. Black Swans are also apparently decreasing through eating out their own food supply. In Australia and Tasmania the Black Swan has decreased with the advance of settlement partly through wholesale shooting by sportsmen.

Nesting. The Black Swan usually breeds among reeds on the edges of lagoons or on small islands. The nest is a large pile of sticks, rushes, raupo and grass with the egg hollow lined with down. The breeding season occupies most of the year. Stidolph notes that in the Wairarapa district nesting takes place from June until autumn with the peak about the end of the year. Apparently the nesting period in New Zealand is longer than it is in Australia. The period of incubation is about five weeks and the cygnets are able to leave the nest shortly after they are hatched.

References.—Latham, Ind. Orn., 2, 834, 1790 (*Anas atrata,* N.S.W.). Littler, Birds Tas., 212, 1910. Thomson, Nat. Anim. Plants N.Z., 106, 1922; Wild Life N.Z., pt. II, 10, 1926 (*Chenopis atrata*).

Mallard

Anas platyrhynchos

Attempts have been made to naturalise the Mallard in New Zealand since 1867 when the Otago Acclimatisation Society im-

Lake Ellesmere *K. V. Bigwood*

BLACK SWAN

Masterton *J. M. Cunningham*

MALLARD DUCK

ported a pair from Melbourne. In nearly all cases the species has failed to become established. However, Mallards are now to be found in several districts, in some localities in very large numbers. At present they are frequently imported, reared in game farms, and constantly liberated.

Adult Male. Head and upper neck rich glossy green; a narrow white collar broken behind; mantle and scapulars grey, minutely barred with brown; back dark umber-brown; rump and upper tail coverts black; wings ash-brown; speculum glossy purple-blue, margined in front and behind by a black and a white band; four central tail feathers black and recurved, remainder pale grey, edged with white. Upper breast deep chestnut; lower breast, sides and abdomen greyish white, waved with narrow dark lines; under tail coverts black. Bill yellowish green, black at tip, reddish yellow at base of lower mandible. Iris brown. Feet reddish orange. Bill 55, wing 280, tail 110, tarsus 46, mid toe 65 mm. *Adult Female.* Upper surface dark brown, the feathers edged with brownish buff; wings as in the male; tail feathers brown, edged with pale buff. Under surface buff, streaked with dark brown. *Nestling.* Dark brown above, pale brown below, buff on throat; white spots on wings and sides, buff stripe over eye and dark brown stripe through eye. *Immature and Male in winter* resemble the adult female. *Hybrids.* The Mallard crosses with the Grey Duck producing birds with some characteristics of both species, but Mallard is usually dominant.

Distribution. Throughout the North and South Islands from Thames Valley southwards. Reported in large numbers at Lake Ellesmere, Washdyke and Waikouaiti. Straggler to Macquarie Island.

Northern Hemisphere from the Arctic Circle south to Madeira, Abyssinia, North India, China and Panama.

Ecology. At first difficult to establish the Mallard is now found in many localities. In part this is due to frequent liberations. It quite frequently breeds with the native Grey Duck and besides producing mongrels is said to be replacing the Grey Duck. It is, for example, reported as more plentiful than the Grey Duck at Washdyke, on the Waikouaiti lagoons and on the Taieri plain. Balham gives the food of the Mallard and Grey Duck (combined) as 99 per cent. vegetable matter, 87 per cent. of it duckweed.

References.—Linne, Syst. Nat., 10th ed., 125, 1758 (*Anas platyrhynchos,* Sweden); p. 127 (*A. boschas*). Thomson, Nat. Anim. Plants N.Z., 101, 1922. Wild Life N.Z., pt. II, 6, 1926. Balham, Emu, 52, 163, 1952.

FAMILY STRIGIDAE

Little Owl

Athene noctua

Mr. G. H. Howes of Dunedin relates the incidents leading to the importation of the Little Owl as follows. On account of imported small birds raiding orchards in Central Otago the Government asked the Otago Institute to suggest a remedy. The Institute recommended the Little Owl and the Government instructed the Otago Acclimatisation Society to bring in supplies.

Several shipments of the Little Owl were introduced into Otago between 1906 and 1910, the first being 28 birds imported from Germany. From these importations, other parts of the Dominion have been stocked, or, as in the case of Stewart Island, birds have spread of their own accord. Birds transferred to the North Island did not become established unless some recent reports of their presence in the Wellington Province prove to be correct.

Adult. Head brown with triangular spots of white; upper surface brown, mottled with oval spots of white; quills brown, barred with paler brown; upper tail coverts brown, barred with yellowish white; tail brown with four bands of whitish brown and tipped with whitish. Sides of face, chin and throat white with a brown band across the throat; rest of under surface white, streaked with brown. Bill, iris and feet yellow. Bill 17, wing 170, tail 90, tarsus 32, mid toe 30 mm. This species can be distinguished from the Morepork by the white face, brown band across throat, and white under surface with brown stripes.

Eggs. Clutch four to six, spheroidal, white. 34 x 28 mm.

Distribution. Abundant from Mid-Canterbury to Foveaux Strait east of the area of heavy rainfall. Extending into North Canterbury and reported from some localities in Nelson and Marlborough (Hump Ridge and Wairau). Entering the area of heavy rainfall at Inchborne (Westland), Puysegur Point and Stewart Island. In the North Island the Little Owl has been reported in several localities in the Wellington Province but no specimens have been taken.

Europe, Tangier, Asia Minor.

Ecology. The Little Owl has taken up its abode near towns and in the open country. It is said not to go into the forest, though it hunts along its edge. Being a carnivorous bird, and an active one, its depredations have brought it into contact with many kinds of small birds both native and introduced. Reports on its value to agriculture and its effects on the native birds are somewhat contradictory. At any rate some benefits may be claimed from it and also, perhaps more, harm. There are two main points in its favour. The first is the killing of small birds which have become so numerous as to be a nuisance. One orchardist says that, without the help of the Little Owl, he would be unable to produce a good crop of fruit. The second point is the ridding of orchards and farm lands of harmful insects. Apparently, however, non-predatory birds like the thrush, blackbird and starling, can do this work better. A report from Otago says that as these small birds disappear owing to the ravages of the Little Owl, grass grubs take a firmer hold. As to the harm done by the Little Owl numerous witnesses testify to its killing native birds. The list includes fantails, bellbirds, tomtits, grey warblers, rifleman, pipits, white-eyes, kingfishers, shining cuckoos and grey ducklings from the Avon River. A report from Owaka in Southland states that by 1932 fantails had almost been cleared out. The following introduced species of birds are reported killed by the Little Owl: thrush, blackbird, starling, sparrow, greenfinch, goldfinch, hedge sparrow, redpoll.

The stomach contents of 242 Little Owls were studied by Marples. Of the remains of twenty birds found Marples notes that, with two doubtful exceptions, none of them were native species. It is too much to believe that the Little Owl distinguishes between native and introduced species, and seeing that Marples carried out his investigations about thirty years after the Little Owl was first imported, probably by that time most of our trusting defenceless wild birds accessible to the Little Owl had been seriously reduced in numbers by this owl and so their remains would not be expected to occur in stomachs and castings. A similar analysis was made in England by Miss Hibbert-Ware who found that "birds take their place with insects and rodents as an important food constituent during the nesting season." Birds commonly taken were starlings, skylarks, house sparrows, hedge sparrows, blackbirds, song thrushes, yellowhammers, goldfinches, that is, mostly species which usually feed on or near the ground. The report is an extremely valuable one but one critic points out that the Little Owl kills ducklings and young pheasants and eats only their brains. Consequently no evidence of such depredations would appear in the work carried out by Miss Hibbert-Ware. In view of the evidence summarized above I cannot help thinking that E. F. Stead's judgment that the liberation of the Little Owl was one of the worst mistakes of acclimatisation in New Zealand, is correct.

Food. The bulk of the food taken by the Little Owl consists of insects. Marples gives the principal kinds as caterpillars, earwigs and beetles. The vertebrates are birds, mice, rabbits, frogs and lizards. Snails and worms are occasionally eaten. The Little Owl is a ground feeder. It does not usually take its food on the wing, but there is a report from Kyeburn of a hedge sparrow being taken on the wing in broad daylight.

Nesting. The Little Owl does not bother much to make a nest. It merely lays its eggs in a hole in a tree or in a bank, or in a building, or in a deserted rabbit burrow.

References.—Scopoli, Ann. Hist. Nat., 22, 1772 (*Strix noctua*, Carniola). Thomson, Nat. Anim. Plants N.Z., 138, 1922; Wild Life N.Z., pt. II, 23, 1926. Marples, Trans. Roy. Soc. N.Z., 72, 237, 1942. Hibbert-Ware, British Birds, vol. 31 and separate report, 1938.

FAMILY PHASIANIDAE

Pheasant

Phasianus colchicus

Two subspecies of Pheasants belonging to the same species have been introduced into New Zealand, the English Pheasant (*P. c. colchicus*), and the Chinese Pheasant (*P. c. torquatus*). The so-called English Pheasant is really an introduction to England from south-east Europe but now, as in New Zealand, English Pheasants are largely crossed with Chinese Pheasants. The two subspecies have freely interbred in New Zealand and in most cases the hybrids are more like the Chinese subspecies. The eggs now being imported from England are of the same mixture as the Pheasants established here. For all, we can use the scientific name given above as the two subspecies belong to the same species.

English pheasants were first introduced in 1842 by Mrs. Wills who brought a cock and three hen birds to Wellington. Many more importations subsequently took place between that date and 1869, the separate shipments being detailed by the Hon. G. M. Thomson in his great work on the *Naturalisation of Animals and Plants in New Zealand.* The same author states that in 1851 Mr. Henderson imported some Chinese pheasants direct from China, and released them at Waitakere near Auckland. Subsequent shipments arrived at Auckland and Wellington. A good deal of transferring of birds from one part of New Zealand to the other took place and by about 1870 pheasants of both species were common in most parts of New Zealand. Since then there has been a steady decline, and at the present time eggs are imported from England by air and incubated on game farms, and birds are constantly being liberated.

Adult. Most New Zealand birds have a white ring round the neck, and the lower back and upper tail coverts greenish slate, characters derived from the Chinese parent. In the English pheasant (*P. c. colchicus*) the lower back, rump and upper tail coverts are rufous buff, mottled with black and red, and glossed with purplish. In the Chinese pheasant (*P. c. torquatus*) these parts are greenish or bluish slate with a rust-coloured patch on each side, while there is a wide subterminal dark green band on the feathers of the lower back and rump. In *P. c. torquatus* the black bar on the basal part of the central tail feathers is wider than it is in *P. c. colchicus.*

A pure white cock bird that lived on a farm in the Clevedon district for a period of three years is recorded by H. R. McKenzie.

Eggs. Pyriform, olive, 44 x 35 mm. (av.).

Distribution. North Island, common in the Bay of Plenty district and northwards. Less common to scarce elsewhere in the North Island and in the South Island.

Originally in Western, Northern and Central Asia (*P. c. colchicus*); Eastern Asia from Lower Amur to South China (*P. c. torquatus*). Both subspecies now naturalised in many parts of the world.

Ecology. On the first importations of Pheasants being made increases in numbers were quickly apparent and establishment of the species seemed certain. About 1870 a rapid decline set in. Evidently several factors contributed to this. Fires destroyed many birds and their eggs and chicks. Small birds, especially starlings, ate insects that were necessary for rearing the young pheasants. Wekas took the eggs which, according to Fitzgerald, are necessary for their own young. Harriers preyed on the chicks and many Pheasants succumbed from eating poison laid for rabbits. Finally, about 1882, ferrets began to be imported and when they and stoats spread about the country the debacle was complete. The intricacy of the web of life is well illustrated by these relationships.

The Pheasant's relation to the agriculturist has been anything but happy. Where it has become common it has proved very destructive to grass and cereals, especially at the time they appear above the ground, also to potatoes and all kinds of vegetable crops and many kinds of fruit, strawberries and grapes especially suffering. Against this damage must be set the enormous numbers of insects destroyed by Pheasants. The Pheasant is found in the open country and settled districts, including the fern and tutu country which occupies considerable areas in the North Island.

Nesting. The Pheasant is a polygamous species, each cock associating with from six to nine hens. The breeding season lasts from September to November, each hen laying from six to fourteen eggs in a nest consisting merely of a few leaves in a depression in the ground, generally located in the open or semiforested country. The period of incubation is from 24 to 26 days.

References.—Linne, Syst. Nat., 10th ed., 158, 1758 (*P. colchicus,* Colchis). Gmelin, Syst. Nat. 742, 1788 (*P. torquatus*). Drummond, Trans. N.Z. Inst, 39, 247, 1907. Thomson, Nat. Anim. Plants N.Z., 111, 1922; Wild Life N.Z., pt. II, 12, 1926.

Swamp Quail

Synoicus ypsilophorus ypsilophorus

This Tasmanian subspecies was imported and released near Auckland in 1869. Since then it does not appear to have been reported on more than three occasions. This subspecies may now be extinct in New Zealand, or swamped by crossing with the more common subspecies *australis.*

Adult. Larger than *S. australis* and with the markings more distinct. The rufous on the upper surface is more distinct.

Eggs. Clutch seven to thirteen, ovoid, greenish yellow, spotted with olive-green, 32 x 24, 31.7 x 25 mm. Tasmania.

Distribution. North Island: reported from Bay of Islands, Pirongia and Wairarapa.

Tasmania.

Habits. The Swamp Quail in Tasmania favours swampy localities and is seldom found in cultivated fields. Its nest is a depression in the ground lined with grass and is usually placed among thick vegetation in marshy places.

References.—Bosc. Journ. Hist., 2, 297, 1792 (*Coturnix ypsilophorus,* Tasmania). Littler, Birds Tas., 108. 1910.

Brown Quail

Synoicus ypsilophorus australis

The Brown Quail was imported into Canterbury in 1866, and during the following ten years several more importations were made and the subspecies liberated throughout the North and South Islands. In 1871 the Auckland Acclimatisation Society imported 510 Brown Quail.

Adult. Upper surface barred and mottled rufous and black with white centre lines to the feathers; quills brown, the outer margin mottled with rufous. Throat buffy white; under surface buff with narrow wavy black bars and faint white shafts to the feathers; under tail coverts buff with broad black bars. Bill bluish. Iris red. Feet orange. Bill 14-15, wing 97-100, tail 47-50, tarsus 22-24, mid toe 26-27 mm. Three Kings. (Turbott and Buddle). The female has the black markings on the upper surface coarser and the shaft stripes pale buff. *Nestling.* Above chestnut-red striped with black, below whitish. *Colour Variety.* A specimen from the East Coast of the North Island has the general coloration brownish slate, upper surface obscurely mottled with blackish brown, wings washed with chestnut brown.

Eggs. Clutch seven to eleven, pyriform, white or greyish white with fine light brown markings or numerous dark brown freckles, 29 x 23, 27 x 22 mm. North Australia.

Distribution. Fairly common in the Bay of Plenty and northwards, including the Three Kings and Mayor Island. It has been seen on Mokohinau and Little Barrier Island. In Taranaki, Hawke's Bay and Wellington provinces it is scarce.

Australia. Other subspecies in Moluccas, New Guinea, New Britain and Tasmania.

Habits. The Brown Quail is quite common especially in the Auckland district in the open scrub and grass country. It is encountered in small coveys, and on being flushed flies a short distance and settles again. Its nest is placed under cover of thick vegetation and consists of a depression in the ground lined with grass. The food of the Brown Quail consists of insects, seeds, and occasionally snails and clover leaves.

The Brown Quail is kept in check, or in several localities is decreasing, through burning, through grass being replaced by manuka scrub, and through the depredations of cats, rats, stoats and harriers.

References.—Latham, Ind. Orn. Supp., 62, 1801 (*Perdix australis,* Sydney). Mathews, Birds Austr., 1, 67, col. pl. 1910. Thomson, Nat. Anim. Plants N.Z., 118, 1922; Wild Life N.Z., pt. II, 15, 1926.

Virginian Quail. Bob-white

Colinus virginianus

In 1898 the Wellington Acclimatisation Society imported about 400 birds and the following year over 750 and distributed them throughout the country from Auckland to Southland. During the next ten years they gradually disappeared and none were reported for many years after this. In 1922, however, a number were taken at Waingaro, South Auckland, and in 1952 the species was taken at Wairoa, Hawke's Bay.

Adult Male. Forehead black; top of head rufous chestnut mottled with black; hind neck mottled chestnut, white and black; mantle vinaceous rufous; lower back, rump, upper tail coverts and tail olive-grey finely mottled with dusky and buff; wing coverts, scapulars and outer secondaries rufous mottled with black and white; quills greyish brown. Lores and superciliary stripe buffy white; a black band through eye to ear coverts; chin and throat white, margined by a black band across the foreneck; upper chest vinous rufous; breast and abdomen buff with wavy black bands; sides chestnut striped with white and black; under tail coverts rufous blotched with white. Bill 14-18, wing 104-119, tail 52-70, tarsus 28-34, mid toe 37 mm. *Adult Female.* Differs from the male in the throat being bright buff; the black bands on the face and throat are ill defined.

Eggs. Pyriform, white, 31 x 24 mm. (av.).

Distribution. Waingaro. Waikaremoana, Wairoa.

United States from Dakota, Indian Territory and Texas eastwards to the Atlantic.

Habits. The Bob White is said to have a most impetuous flight and to cover a wide range in search of food and cover. When a young brood is startled the mother goes through all sorts of antics, feigning injury, in order to draw away the intruders. The nest is a slight depression in the ground lined with leaves and, in the Southern United States, two broods are commonly reared. The food of the adult birds is mainly seeds and berries but the chicks are at first fed on insects.

References.—Linne, Syst. Nat., 10th ed., 161, 1758 (*Tetrao virginianus*). Thomson, Nat. Anim. Plants N.Z., 127, 1922; Wild Life N.Z., pt. II, 19, 1926.

Californian Quail

Lophortyx californica brunnescens

The Californian Quail was first imported into the Nelson district in 1865, and during the following ten years into the Auckland, Canterbury, Otago, Southland and Wellington districts. By 1890 it became so plentiful in the Nelson district that large numbers were frozen and exported to England. Both *L. c. brunnescens* and *L. c. californica* have been identified from New Zealand.

Adult Male. A crest of black club-shaped feathers. Forehead yellowish buff; a white band crossing the head above the eyes; top of head brown, edged with black; throat and cheeks black, bounded by a white band; feathers of hind neck grey spotted with white and with black margin and midrib; back, rump and upper tail coverts olive-brown, the wings darker, greater wing coverts and secondaries edged with buff, tail slate-grey. Upper breast slate; lower breast buff barred with black; abdomen chestnut barred with black; sides brown with white stripes; under tail coverts buff with brown centres. Bill 11-14.5, wing 103-117, tail 85-94, tarsus 32-40, mid toe 30-38 mm. *Adult Female.* Crest shorter and browner; no black and white pattern on the head, most of the feathers being whitish with dark centres; neck and chest olive brown; rest of under surface white tinged with buff on abdomen. *Nestling.* Above light buff; pale brown on middle of forehead; crown and occiput brown bordered by blackish; fuscous line on each side of spine and a similar one on each side of the back; on each wing a humeral line and two incomplete transverse bands of blackish brown. Under surface dull white tinged with buff, except middle of abdomen which is white.

Eggs. Clutch 12 to 16, pyriform, creamy white, spotted and blotched with dark and yellowish brown, 32 x 25 mm. (av.).

Status. Similar to *L. c. californica* but darker, the upper parts much browner; breast deeper, more slate coloured. In the female the breast is less greyish than in *L. c. californica.*

Distribution. North and South Islands; abundant in many places; Kapiti, Chatham Islands.

Humid coast region of California from northern border to Santa Cruz County. Birds from New Zealand have become established in Norfolk Island.

Ecology. The Californian Quail is common in open country especially hilly regions cleared of forest and in fern and tutu country. Its acclimatisation in New Zealand has been most successful, perhaps because this subspecies comes from the humid region of the Pacific coast of North America. It is, however, reported to be decreasing in some districts. Many are killed by fires; some are poisoned by eating phosphorised grain laid for small birds or for rabbits; stoats and cats take their toll; and hedgehogs eat the eggs. There have been complaints that grapes and strawberries have been ruined, and that sown seed has been eaten by these quails. The Californian Quail is a useful bird as it eats seeds of weeds and insects.

Food. The Californian Quail is almost entirely a vegetable feeder, at least that is the finding of G. R. Williams who carried out investigations on the life history and ecology of this species in New Zealand. Williams found that seeds and fruit formed the greater part of the quail's diet; grasses, clover and other leaves, including those of native plants, come next; animal matter, chiefly insects, occur in small quantities.

Nesting. Stidolph's account may be quoted here. "The nest of the Californian Quail is one of the most difficult to find. In fact the only chance of coming across it is by accidentally flushing the sitting bird, which often rises at your feet. The nest itself is a simple affair, a hollow in the ground lined with grass and made comfortable for the big batch of eggs. In most cases there is a canopy of grass over the nest, which must be as cosy as any nest could be. A site in the midst of long grass, under a log or small bush, perhaps a straggling blackberry, is usually selected." The laying season is mainly October, November and December. The period of incubation is about twenty-three days, and this duty is carried out by the hen bird. "As soon as they are hatched," writes Thomson, "the chicks run about and feed on insects and small seeds. When alarmed, the old bird gives one or two notes of warning and flies away. The young, while still too small to fly, hide quickly under any convenient cover, and lie close to the ground until the danger is passed, when they are called together again by the parent." After the breeding season the Californian Quail is to be met with in small flocks.

References—Shaw and Nodder, Nat. Misc., 9, pl. 345, 1797 (*Tetrao californicus*). Ridgway, Proc. Biol. Soc. Wash., 2, 94, 1884 (*L. c. brunnescens,* Santa Barbara). Thomson, Nat. Anim. Plants N.Z., 124, 1922; Wild Life N.Z., pt. II, 17, 1926. Ridgway, Bull. U.S. Nat. Mus., 50, pt. X, 284, 1946. Gurr, Notornis, 4, 144, 1951. Williams, Jour. Wildl. Man., 16, 460, 1952. (Reprinted N.Z. Dept. Int. Aff.).

Chukor

Alectoris graeca chukar

About fifteen pairs of Chukor were released in the Lake Heron district in 1926. The following year 25 birds were liberated at the head of Lake Hawea. In the North Island 24 birds were turned out near Taumarunui in 1929, but they died out. In 1950 a small number from the South Island were transferred to the Coromandel Peninsula. Summing up, Williams in 1951 said: "All the Chukar in New Zealand have had their origin from apparently 500 birds set free in nineteen liberations." Later in the same year he said that Chukor are still extending their range in the South Island. One shipment of 192 birds belonged to the Persian race, *A. g. koroviakovi,* and, according to Williams, from these the Chukor in North Canterbury and Marlborough have had their origin. Later he says that measurements of Otago and Marlborough birds are quite in conformity with the supposition of two races being present in New Zealand.

Adult Male. Upper surface ashy, tinged on the crown and shoulders with vinous red; a black band across the forehead extends through each eye and down each side of the neck to join above the breast; the area enclosed by this band, that is, the cheeks, chin and throat, is buffy white; breast ashy tinged with brown; abdomen buff; sides conspicuously barred with chestnut and black. Bill 17, wing 165-170, tail 100-106, tarsus 46, mid toe 42 mm.

Eggs. Clutch 10-16, greyish, freckled with brown spots. 43 x 31.7 mm. (av.).

Distribution. A broad belt in the centre of the South Island extending from inland Marlborough to Central Otago.

Southern slopes of the Himalayan Range as far eastward as Nepal. Also in the Punjab and southern Kashmir.

Ecology. The Chukor is now well established in the high country east of the Southern Alps, preferring rocky faces where the ground is dry. It is, however, seldom found far from water. According to Williams it flourishes best where the rainfall is less than 25 inches a year. In Otago the birds are found mainly below an altitude of 2,000 feet, but there is an upward movement in summer when they may reach 5,000 feet. The Chukor is the prey of stoats, cats and hedgehogs. In Central Otago, especially during the nesting season, large numbers are reported to be killed by eating poisoned carrots and swedes laid for rabbits, and they are often caught in rabbit traps.

Food. Crops of birds taken in New Zealand and examined by Williams yielded seeds of matagauri (tumata-kuru), coprosma, hymenanthera, pohuehue, tussock grass, briar and weeds; leaves of coprosma, pohuehue, matagauri, clover and weeds; also a small amount of insect material. The insects were mostly grasshoppers, flies and green manuka beetles.

Nesting. Williams gives the breeding season in Central Otago as September to March, but mostly in November, December and January. The nest, which is merely a hollow in the ground, is placed among rocks or grass, frequently in the shelter of a tree or shrub.

References.—Gray, Ill. Ind. Zool., 1, pl. 54, 1830-32 (*Perdix chucar*). Williams, N.Z. Sci. Rev., 8, 2, 1950; Notornis, 4, 151, 1951. Marples and Gurr, Emu, 53, 283, 1953.

Peafowl

Pavo cristatus

According to E. J. Wakefield the first Peafowl to be introduced to New Zealand were brought to Wellington in 1843 by Mr. Petre. Many subsequent introductions took place and occasionally, in the North Island, birds escaped and ran wild. About 1862 Peafowl were liberated by Meinertzhagen at Waimarama, Hawke's Bay. This colony still exists.

Adult Male. The long train of ocellated feathers in the male arises from the lower back and includes the upper tail coverts. The true tail is unornamented and forms a support for the train. There is a crest of bare shafts and fan shaped tips in both sexes. All the feathers in the train end in an "eye" with a black centre surrounded by blue, coppery and then an outer rim of green and bronze. The female has no train and is mainly of a brown colour. Domesticated birds occasionally produce all white individuals.

Distribution. Near Gisborne. Mahia, Waimarama, Wairoaiti and near Tutira, Hawke's Bay. Both sides of Wanganui River between Tokomaru East road and Longacre. Formerly Turakina and Wangaehu valleys.

India, Ceylon.

Habits. In the wild state the Peacock rests on trees at night with or without his hens. The food of the Peafowl includes fruits, seeds, buds, insects and small reptiles.

Reference.—Linne, Syst. Nat., ed. X, 156, 1758 (*Pavo cristatus*, India).

FAMILY NUMIDIDAE

Guinea Fowl

Numida meleagris

The Rev. R. Taylor states that missionaries first introduced Guinea Fowls into New Zealand at the Bay of Islands. About 1864 a shipment arrived from India. The Otago Acclimatisation Society introduced 23 birds in 1867 but, according to Thomson, they failed to reproduce themselves, apparently because of the severity of the winter weather in Otago. Guinea Fowls were liberated in the North Island in several localities, or were abandoned when homesteads were vacated, and in some places they became established.

Adult. A forwardly directed crest behind the casque; band down nape and hindneck, and collar below bare skin dark brown.

Broader band round lower neck greyish brown. Rest of body with small white spots on dark background, brown on upper surface, black on sides and under surface, where the spots are larger. Bill reddish brown. Iris dark brown. Feet light brown. Bare skin on head bluish white; wattles and lobes at base of culmen red; casque and adjacent patch on either side to eye dark brown. New Zealand domesticated bird.

Distribution. Feral Guinea Fowls have been reported in New Zealand inland from Wanganui and in the middle Waikato district. In the latter locality flocks of considerable size were encountered during 1938. Guinea Fowls were introduced to Raoul Island by T. Bell in 1906 and were last reported there in 1909.

Numida meleagris is found in North Africa from the Atlantic to the Indian Oceans and in south-west Arabia.

Habits. Guinea Fowls are prolific breeders so soon increase in a feral state. Naturally wanderers their domestic associations are easily severed. When disturbed they may run swiftly away keeping under cover or they may hide until one is close upon them when they rise suddenly and fly rapidly to a safe distance.

Reference.—Linne, Syst. Nat., ed. X, 158, 1758 (*Phasianus Meleagris,* Africa).

Wild Turkey

Meleagris gallopavo mexicana

Turkeys have gone wild in several districts in New Zealand. In the 1890s there were wild turkeys in the Hawke's Bay, Canterbury, and Nelson provinces and in the Chatham Islands, but they were mostly in the vicinity of the homesteads from which they strayed, and, after a while, they disappeared. There are, however, at the present time Wild Turkeys in some localities in the Wellington, Hawke's Bay and Marlborough provinces which seem to be permanently established.

Adult Male. The domestic turkey is derived from the Central Mexican subspecies, *mexicana,* of *Meleagris gallopavo,* the only species of the genus now recognised. The seven subspecies do not differ from one another very much. *M. g. mexicana* is described as: "Similar to that of *M. c. gallopavo* but with the upper back and wing coverts duller, more purplish bronzy, and with the lower back and rump with some coppery and greenish-golden metallic reflections as in *sylvestris* and *osceola*, rather than bluish black as in *gallopavo,* and larger, like *merriami* in size. *Adult Female.* Similar to that of *M. g. gallopavo,* but with general dorsal coloration duller, more dusky purplish, less of the coppery and greenish-metallic reflection." (Ridgway and Friedmann). *Male*: bill 39, wing 504, tail 396, tarsus 174 mm. *Female*: 34, 420, 335, 134 mm. (av.).

Distribution. Inland from Tutira (Hawke's Bay), Wanganui, and Kaikoura.

Provinces of Chihuahua, Durango and Jalisco (northern portion), Mexico.

Ecology. Wild Turkeys are reported to have disappeared from localities where they had established themselves because the insects on which their young were reared were eaten out by starlings.

References.—Linne, Syst. Nat., ed. 10, 156, 1758 (*Meleagris Gallopavo,* North America). Gould, Proc. Zool. Soc., 1856, p. 61 (*M. mexicana* [Balanos]). Thomson, Nat. Anim. Plants N.Z., 108, 1922. Ridgway and Freidmann, U.S. Nat. Mus. Bull. 50, pt. X, 455, 1946.

FAMILY COLUMBIDAE

Rock Pigeon. Rock Dove

Columba livia livia

"There does not," states the Hon. G. M. Thomson, "seem to be any record of the first introduction of domestic pigeons into New Zealand, but we may be fairly certain that they were brought into the country in the very early days of European settlement."

Adult. Head slate-grey; neck metallic green changing to purple on lower part, especially on upper breast; back and wing coverts pale grey; wings with two black cross bars, one on greater wing coverts the other on the secondaries; quills blackish grey; rump white; upper tail coverts dark grey; tail slate-grey with a broad apical black band. Lower surface slate-grey, darker on breast and under tail coverts. Bill slate colour, whitish on cere. Iris orange-red. Legs red. Bill 20, wing 220, tail 115, tarsus 30, mid toe 33 mm.

The above description is that of the European Rock Dove from which all the domesticated varieties have arisen. Several varieties have become naturalised and have interbred so that birds of all colours are found, and included among them many that approach the wild state. It is a well known fact that the indiscriminate mating of different domestic varieties usually leads to reversions to the wild state.

Eggs. Clutch two, white, 39 x 29 mm. (av.).

Status. The two conspicuous black bars on the wings are characteristic and distinguish the Rock Dove from the Stock Dove and the (English) Wood Pigeon.

Distribution. Naturalised both in the cities and in country districts throughout. Has visited Kapiti Island.

Originally in Europe, North Africa and Asia as far east as India. Naturalised in many parts of the world.

Habits. The Rock Pigeon is found in almost any place where it is not too much molested. It frequents the streets of all our towns, breeding on ledges in the buildings. It nests under the wharves in Wellington Harbour. In the country districts it reverts to its true habitat among cliffs, where it breeds. Large numbers breed on the sea cliffs on the south coast of Banks Peninsula.

In the cities Rock Pigeons probably do little harm except in the way of disfiguring some of the buildings. Most people probably like to see them about the streets and for some they are quite an attraction. Small groups of pigeons are regular attendants in places where people can sit outside and eat their lunch. In the country districts they are shot for food. In some districts the Rock Pigeon has become a nuisance, large flocks plundering crops and feeding on recently sown oats. The Rock Pigeon is capable of adapting itself to almost any conditions. In the Dominion Museum is a nest taken from a building in Wellington and composed almost entirely of pieces of wire, including insulated wire, and nails.

References.—Gmelin, Syst. Nat., 1, 769, 1789 (*Columba livia,* South Europe). Thomson, Nat. Anim. Plants N.Z., 134, 1922; Wild Life N.Z., pt. II, 21, 1926. Witherby et al., Handbk. Br. Birds, 4, 137, 1948.

Indian Spotted Dove

Streptopelia chinensis tigrina

The Indian Spotted Dove has established self within recent years in the city and suburbs of Auckland. It is a favourite cage bird and presumably has escaped from captivity from time to time.

Adult. Head vinous grey; a broad black band finely spotted with white across the hind neck and the upper back; remainder of upper surface brown, spotted on the upper back and wings with rufous; quills dark brown; outer tail feathers black broadly tipped with white, the two middle ones brown. Under surface greyish pink, paler on the throat; under tail coverts whitish. Bill black. Iris hazel, skin round eye reddish. Feet purplish red, claws black. Bill 15-17, wing 142-160, tail 123-154, tarsus 13 mm.

Eggs. Clutch two, white, 27 x 22 mm.

Distribution. Auckland city and suburbs.

Bengal, Burma, Indo-China, Malaysia. Introduced to Australia.

Habits. The Indian Spotted Dove, like the Rock Pigeon, readily takes up its residence in towns and villages, where it finds food in back yards and fowl runs. The nesting season lasts throughout the year though chiefly in spring and summer. The nest, according to Serventy and Whittell, is an untidy cup-shaped structure of stems and rootlets, cemented together by excreta.

References.—Scopoli, Del. Flor. Faun. Insubr., 94, 1876 (*Columba chinensis*). Temminck, Hist. Nat. Pig. 1, 94, 1811 (*Columba tigrina,* Java).

FAMILY ALAUDIDAE

Skylark

Alauda arvensis

Large numbers of the Skylark were liberated in various parts of New Zealand between 1864, when 20 were imported to Nelson, and 1879, when 70 were released on Stewart Island. Everywhere they quickly became established and soon stocked the settled districts. The Skylark was introduced to the Chatham Islands by L. W. Hood towards the end of last century.

Adult. Head crested. Upper surface brown, streaked with black centres to the feathers which have pale edges; wing coverts and quills dark brown, margined with tawny, or on the greater coverts, whitish brown; the first long primary white along outer web; inner primaries and outer secondaries tipped with whitish; tail feathers blackish brown, edged with tawny, the outer pair white except for blackish mark on inner webs, the next pair white on outer webs. Lores, above and below eye, buff; sides of face buff, spotted with black; throat buffy white, dotted with black; foreneck, chest and sides of body buff with black streaks and spots; abdomen and under tail coverts whitish. Bill greyish brown, base of lower mandible bluish flesh colour. Feet yellowish brown. Bill 15, wing 115, tail 70, tarsus 25 mm.

Ashley River *K. V. Bigwood*

SKYLARK

Colour Varieties. A black Skylark has been reported; albinos have been seen in Ashburton and the Wairarapa; a creamy white specimen was taken at Fordell.

Eggs. Clutch three to five, yellowish cream, thickly blotched all over with light brown and grey, most dense at larger end. 22.6 x 16.2, 23 x 16.4, 23.4 x 16.4 mm.

Distribution. Raoul Island. Common from the North Cape to Stewart Island. Little Barrier Island, Poor Knights, Mokohinau, Kapiti, Chatham and Auckland Islands.

The New Zealand subspecies is probably *A. a. arvensis* which is found in Europe with the exception of south Italy, south-east Europe and the Mediterranean Islands. Other subspecies in south-east Europe, west and middle Asia and North Africa.

Ecology. The Skylark is found in open country from the coast to high up in the mountains. Though few people would say anything against the Skylark it has been troublesome to farmers and gardeners. To this bird is attributed much damage to seedling wheat, turnips and cabbages. It pulls the young plants out of the ground as they are just appearing above the surface. The *New Zealand Herald,* in 1934, records the pulling up of about 5,000 young tobacco plants by Skylarks. Drummond, who obtained a great deal of information by circularising farmers and others throughout New Zealand rated the Skylark as the most destructive pest after the sparrow. This judgment, however, does not sufficiently take into account the good that Skylarks do by eating insects. An investigation of its stomach contents by W. E. Collinge working in England showed that 36.5 per cent. of its food was beneficial and only 13 per cent. was injurious.

Habits. The Skylark in New Zealand nests from October to January. The nest is placed in a hollow in the ground under cover of a tuft of vegetation and is made of grass lined with finer grass. The food of the Skylark is mostly seeds, including grain, fruit and insects. The young are fed on insects and worms. The Skylark usually sings on the wing but not for long at a time. It mounts in wide circles, poises for a while and then descends, slowly at first then quickly. The song ceases just before the final descent. The song may be heard from before sunrise until after sunset. Sometimes a Skylark sings while perched on a tree or post or even while on the ground.

References.—Linne, Syst. Nat., 10th ed., 165, 1758 (*Alauda arvensis,* Sweden). Thomson, Nat. Anim. Pl. N.Z., 140, 1922; Wild Life N.Z., pt. II, 25, 1926. Andersen, Bird Song, 84, 1926. Witherby *et al,* Handbk. Br. Birds, 180, 1948.

FAMILY TURDIDAE

Song Thrush

Turdus musicus

The Thrush was among the earliest of exotic birds to be imported into New Zealand. According to the researches of G. M. Thomson, the first to be landed were five birds introduced to Nelson in 1862. During the following fifteen years, many shipments were landed and released in various parts of the country. They established themselves quickly and are now abundant from end to end of the Dominion. The Thrush made its own way to the Kermadec and Chatham Islands.

I have reverted to the familiar name *Turdus musicus* as Mayr has shown that it was the Song Thrush that Linne intended by this name in his confused account in the tenth edition of his *Systema Naturae* (1758). Linne himself revised his work in the twelfth edition (1766) where he accurately described the Song Thrush under the name *Turdus musicus* and listed its proper references. If Linne's amended account, 1766, be not accepted as the first entry of the Song Thrush into scientific literature the name *musicus* would have to give place to *ericetorum.*

Adult. Upper surface olive-brown; wing coverts tipped with buff; quills brown with pale brown outer margins; tail brown. Lores buffy brown; eye streak and chin buffy white; throat, breast and flanks buffy yellow, spotted with black; centre of abdomen and under tail coverts white. Bill dark brown, yellow at base of lower mandible. Feet yellowish brown. Bill 20, wing 110, tail 75, tarsus 35, mid toe 24 mm. *Colour Varieties.* Albino Thrushes have been observed at Whakatane and Masterton. At the latter place Cunningham found a nest containing one white and three normal young. Partial albinos have also been recorded.

Eggs. Clutch four or five, ovoid, bluish green with scattered black or dark purplish brown spots chiefly at the larger end, 28 x 21 mm. (av.).

Distribution. Kermadec Islands (Raoul, Curtis). Three Kings Islands. North and South Islands. Poor Knights, Hen, Little Barrier, Kapiti, D'Urville, Stewart, Codfish, Chatham, Snares, Auckland and Campbell Islands. Ascends to 4,000 feet on Salisbury Tableland. Scarce in West Coast Sounds.

Europe, North Africa and Asia as far east as the Yenesei.

Habits. The Thrush is now exceedingly abundant throughout New Zealand in the settled districts and in the scrub and open country, but it does not penetrate the dense bush and is seldom found in the mountains above the forest belt. It feeds on insects, imported snails, worms, and soft fruits including the various indigenous kinds. To crack snail shells, the Thrush takes them in its beak and batters them against a stone or piece of wood. Small heaps of broken shells are often found near a convenient stone. The mornings and evenings are the times for singing and the first songs after moulting are heard in April or May but sometimes as early as March. They generally cease during December.

Ecology. Immense numbers of insects and snails are destroyed by the Thrush, which must therefore rank as one of the birds most useful to man. Unfortunately it is not throughout the whole year that it is entirely useful. When the fruit season comes round, it takes a heavy toll, all kinds of soft fruits being attacked. The hard seeds of fruits pass unharmed through the Thrush and are hence scattered far and wide. Native fruit-bearing trees are thus distributed but so too are many noxious introduced plants such as brier, inkweed, elderberry and blackberry,

Nesting. The Thrush places its nest in a tree or shrub usually only a few feet from the ground. On Raoul Island a Thrush's nest built on a nikau palm leaf was found in 1908. The Thrush's nest is built of grass and sticks and lined with a plaster of decayed wood and grass cemented with saliva. This is often described as mud but earth is only occasionally included. The lining remains more or less moist during the period of incubation. The eggs are laid from May until the end of the year. Two or three broods of young are reared in a year.

References.—Linne, Syst. Nat., ed. X, 169, 1758, amend ed. XII 292, 1766 (*Turdus musicus*, Sweden). Turton, Brit. Faun., 1, 35 (*Turdus ericetorum*, England). Thomson, Nat. Anim. Pl. N.Z., 142, 1922; Wild Life N.Z., pt. II, 29, 1926. Andersen, Bird Song, 30, 1926. Mayr, Ibis, 1952, 532.

Blackbird

Turdus merula

Blackbirds were introduced to Nelson in 1862, a shipment of 26 birds being the first to be liberated in New Zealand. All the other acclimatisation societies followed with importations until in the space of ten years the species was thoroughly established in many parts of the country.

Adult Male. Glossy black, slightly browner on the quills. Bill orange yellow. Feet dark brown. Bill 19-25, wing 104-144, tail 110, tarsus 27-37, mid toe 32 mm. *Adult Female.* Upper surface dark olive-brown; under surface slate-grey, paler on the throat, with obscure dark spots on the throat, breast and flanks. *Immature.* In the male the prevailing colours are brown and pale grey, in the female reddish brown and pale chestnut; in both sexes there are dark spots on the upper parts and dark bars on the underparts. *Colour Varieties.* Albinos have been noted in several localities. At Kihikihi a white Blackbird was observed during two seasons by E. and H. Warren to rear "chicks of broken colour," that is, partial albinos. Presumably the male bird was of normal coloration. Partial albinos are more frequently seen than are pure albinos.

Eggs. Clutch four or five, elongate ovoid, bluish green or greenish brown, closely blotched all over with reddish brown. 27.5 x 20.4, 28.5 x 21, 29.6 x 21.4 mm.

Distribution. Kermadec Islands (Raoul, Curtis). Three Kings Islands. North and South Islands. Poor Knights, Hen, Little Barrier, Mayor, Karewa, Kapiti, Stewart, Solander, Chatham, Snares, Auckland and Campbell Islands.

Europe North Africa and Western Asia to Persia and Turkistan.

Habits. The Blackbird seems to have spread to every part of the country and to most of the outlying islands. It is found not only throughout the settled districts but far into the uninhabited forested areas and on the mountains above the forest belt. Its food consists of insects, snails, worms, seeds and fruits. The Blackbird usually chooses a secluded place in which to sing, and its song is similar to but richer than that of the thrush. The first month during which its full song may be heard is July, but part songs may be heard during the previous three or four months. The song usually ceases in December but has been heard as late as February. The nest is built by the female or by both male and female in a small tree or shrub, or in a tussock, or even on a ledge in a shallow cave. It is constructed of grass matted together with mud and lined with finer grass. Eggs are found from September until December, but in the Auckland district eggs have been found in August and as early as June. The female carries out the incubation during which time she is fed by the male. Incubation normally takes fourteen days, but thirteen and sixteen days have been reported. Both birds feed the nestlings.

The relation of the Blackbird to the agriculturist is in all respects similar to that of the thrush. It is beneficial in that it destroys insects and snails but it is very destructive to fruits; it spreads the seeds of noxious plants and, it is feared, it is displacing the indigenous species of birds, probably doing most harm by feeding on the native fruits.

References.—Linne, Syst. Nat., 10th ed., 120, 1758 (*Turdus merula,* Sweden). Guthrie-Smith, Tutira, 345, 1921. Thomson, Nat. Anim. Pl., N.Z., 146, 1922; Wild Life N.Z., pt. II, 34, 1926. Andersen, Bird Song, 33, 1926. Witherby *et al.,* Handbk. Br. Birds, 2, 136, 1952. McCann, Notornis, 5, 198, 1953. Gurr, Ibis, 1954, 225.

FAMILY PRUNELLIDAE

Hedge Sparrow. Dunnock

Prunella modularis

The Hedge Sparrow was first introduced to Auckland in 1867 and, subsequently, to other parts of the Dominion. It soon became established and is now widely distributed though nowhere abundant.

Adult. Top of head and hind neck greyish brown, streaked with dusky; back reddish brown, the feathers with central blackish brown streaks; rump and upper tail coverts olive-brown; wing coverts reddish brown with fulvous tips; quills dark brown, margined with fulvous brown; tail feathers dark brown with paler reddish margins. Lores and eyebrow grey; sides of face ashy, streaked with white; under surface ashy grey, breast shaded with brown, abdomen whitish. Bill dark brown. Feet orange-brown. Bill 12, wing 74, tail 65, tarsus 22, mid toe 19 mm.

Eggs. Clutch four or five, ovoid, greenish blue, 19.4 x 14.8, 20.2 x 15 mm.

Distribution. Three Kings Islands. North and South Islands from Spirits Bay to Foveaux Strait. Little Barrier, Hen, Kapiti, Solander, Codfish, Stewart, Snares and Campbell Islands. Europe, North Africa, South-west Asia.

Habits. The Hedge Sparrow is met with in the settled districts as far as the forest edge. It has been observed at an altitude of 4,000 feet on Mount Egmont and on the Salisbury Tableland. It does not appear to be very common anywhere, though it is probably often not recognised on account of its resemblance to the house sparrow. It is, so far as has been observed in New Zealand, almost exclusively an insect-eater and thus is an entirely useful species. In Central Otago Hedge Sparrows have cleared green flies (Aphids) from orchards. Part songs may be heard in April and May. They become full from June to August and thereafter decline, ceasing in December or early in January.

The nest of the Hedge Sparrow is generally placed in a thick shrub and not far above the ground, but it has been found in a tree fifteen feet above the ground. Any suitable materials are used in its construction. In one nest the main portion was made of sticks and grass and the lining consisted of tree fern scales and hair. In another, described by Mrs. Moncrieff, the nest was made of twigs, moss and tree fern scales lined with grass, hair and wool. Usually four eggs are laid during the months September to December and two broods may be raised in a year.

References.—Linne, Syst. Nat., 10th ed., 184, 1758 (*Motacilla modularis,* Sweden). Thomson, Nat. Anim. Pl. N.Z., 148, 1922; Wild Life N.Z., pt. II, 37, 1926 Andersen, Bird Song, 46, 1926 Secker, Notornis, 5, 24 1952.

FAMILY STURNIDAE

Starling

Sturnus vulgaris vulgaris

As with several other species, the Nelson Acclimatisation Society was the earliest to introduce the Starling to New Zealand, a batch of 17 birds having been imported about 1862. During the following twenty years, large numbers were landed and released in various parts of New Zealand by acclimatisation societies and private individuals. Starlings were transferred to the

Chatham Islands by L. W. Hood before the end of the century. The species everywhere quickly became established and rapidly increased so that at present it is found in enormous numbers throughout the country and on most of the outlying islands, including those as distant as the Kermadec and Macquarie Islands.

Adult Male in Winter (*April*). Head metallic purplish, all the feathers on crown and hindneck tipped with brownish buff, those on sides of face, chin and throat with creamy white; on the front of the head, below the eye and on the chin the buff tips alone are visible; remainder of body, except quills, tail and under tail coverts, metallic green, the upper feathers tipped with brownish buff, the lower ones with creamy white. Primaries blackish brown with subterminal black patch and brownish buff outer margins; secondaries similar but buff margin wider and extending round tip and within this a black band; tail feathers brownish black edged outside with brownish buff; under tail coverts black with broad edging of pale brownish buff. Bill black. Feet dark brown. Bill 23, wing 130, tail 71, tarsus 30, mid toe 26 mm. (Wellington). In *summer* most of the spots on the under surface and a large proportion of those on the upper surface are lost. Bill yellow. *Adult Female* duller, buff tips to the feathers present to greater or lesser extent throughout the year. *Immature.* General colour brown; reddish brown edges to wing coverts, quills and tail feathers; throat dull white, breast and abdomen brown streaked with white. *Colour Varieties.* Entirely white birds have been taken at Kakatahi and Christchurch.

Eggs. Clutch four or five, ovoid, pale blue, 29.2 x 22, 30.5 x 21.6, 31.5 x 22 mm.

Distribution. Kermadec Islands (Raoul, Curtis). Three Kings Islands. North and South Islands. Mokohinau, Hen, Little Barrier, Great Barrier, Poor Knights, Mayor, Karewa, Kapiti, Chatham, Stewart, Snares, Auckland, Campbell and Macquarie Islands.

Europe. Other subspecies in Faeroes, Azores, South-east Europe and Asia as far east as North-west India.

Habits. The food of the Starling in the main consists of insects but it also eats fruit, grain, eggs of ground-breeding birds, and nectar from flowers. Flax, kowhai and rata are among the species visited for their nectar. Starlings may be seen feeding on the shore among cast-up seaweed in association with gulls, sparrows and rock pigeons. Thomson mentions the following kind of native fruits as being eaten by the Starling: cabbage tree, broadleaf, kahikatea, matai, rimu, miro, fuschia and makomako, while Dr. Greta Cone has reported the stripping of a taupata tree of its ripe fruit by Starlings.

Any site that will hold a nest and give some protection from the weather is good enough for the Starling—cliffs, holes in trees, dense vegetation, buildings, chimney pots, hay stacks. The nests are roughly built of grass and lined with feathers. The breeding season is mainly September to November and the period of incubation was found by Cunningham to be thirteen or fourteen days.

During the winter the Starling resorts in immense numbers to certain roosting places for the night. These are often small outlying islands such as Tokamapuna (near Kapiti), Saddleback (near New Plymouth), Rough Island (Nelson) and Karewa (off Tauranga Harbour), or they may be in plantations of gum or pine trees, or in crevices in cliffs. Every evening there is a gathering at the chosen spot of birds from several miles around. Thousands may be seen wheeling over the trees, turning on the wing like a well drilled air squadron and, as at a word of command, each flock swings towards the trees and disappears. At daybreak they all leave in small groups for their various feeding grounds.

Ecology. The Starling is now excessively abundant in all the settled districts, and in places is found many miles from the nearest human habitation, though it does not penetrate far into the dense forest. It resorts to beaches and intertidal mudflats to feed, generally after the breeding season. By occupying nesting sites and also by the food it takes it is displacing the native species of birds. Pipits have been quoted as having been displaced in part by Starlings. E. T. Frost at the North Cape has described the method of ousting kingfishers from their nesting holes in cliffs. The Starling is the aggressor and by weight of numbers attacks and drives away the kingfishers. Tuis also are said to have suffered from the increase of Starlings, and the same has been said of the introduced quail and pheasants. Otto Finsch, in 1882, said that there were no Starlings in Wellington at that time, their place having been taken by mynas which, he said, will drive out Starlings everywhere. But the enormous increase in numbers of Starlings altered this relationship and now there are Starlings but no mynas in Wellington. However, Starlings and mynas exist together in several localities in the North Island. Drummond records that at Napier Starlings were ousted from their breeding places in the cliffs at Bluff Hill by rock pigeons.

In moderate numbers the Starling is a most useful bird. It consumes immense numbers of insects, especially the injurious grass-eating species, and it was immensely beneficial in destroying cattle ticks in the north of Auckland. Two observations relating to the beneficial work of the Starling are worth quoting, as they illustrate the increase of certain indigenous insects following the replacement of forest and scrub by crops, and the efficient work of the Starling. W. W. Smith says: "Since improved methods of tillage were introduced by the Taranaki settlers, as in other provinces, several species of native cockchafer beetles (Odontria) have increased, as elsewhere in New Zealand, at an unprecedented rate. As the larvae increase in size, and the grass they attack withers, they attract flights of the introduced English starling." Again, Guthrie-Smith relates that a crop of oats when flowering "was attacked by an army of caterpillars, millions of which had appeared as if by magic. At once I rode out to note their horrid depredations, but was surprised to find not caterpillars but starlings in the ascendant, the latter had in a few hours collected in such numbers as entirely to save the threatened crop."

The Starling is not entirely beneficial. It eats both fruit and grain and no doubt its depredations along these lines will become more serious as its numbers increase. Orchardists have reported it as damaging plums, cherries, pears, peaches, grapes and other fruits. It is also said to take bees from the entrances to the hives. It seems clear that the Starling in New Zealand has reached the peak of its usefulness and will, if its numbers are not soon checked, become at times a serious pest in orchards and farms, and an irresistible competitor against the smaller kinds of indigenous birds. The advantage which it has over the native species by virtue of its numbers is rapidly increasing as also is the menace to fruit growers. In Great Britain Starlings have been blamed for spreading foot-and-mouth disease in cattle.

References.—Linne, Syst. Nat., 10th ed., 167, 1758 (*Sturnus vulgaris,* Sweden). Thomson, Nat. Anim. Pl. N.Z., 154, 1922; Wild Life N.Z., pt. II, 45, 1926. Wilkinson, Kapiti Bird Sanct., 145, 1952.

Indian Myna

Acridotheres tristis

"This species," writes G. M. Thomson, "appears to have been introduced in the first instance in all centres by private individuals and by a few of the societies in the early seventies. One of the most remarkable things about them is their increase after their first introduction, and then their subsequent diminution and, in some districts, their ultimate disappearance. The latter appears to have been due, either directly or indirectly, to the Starlings, the increase of the latter coinciding with the decrease of the former."

The overall history of Mynas in New Zealand is that they were liberated in all centres which presumably means from Auckland to Dunedin. At first they increased rapidly, afterwards they began to disappear in most places. They are now absent altogether from the South Island, which is understandable if they are affected by cold weather and no doubt this is the case. Why they disappeared from Auckland, which present movements show is eminently suitable for them, is a mystery. They became best established in the Hawke's Bay province and from there have tended to move northward and are now rapidly expanding in the South Auckland area and are entering the North Auckland peninsula. J. M. Cunningham who made a study of their distribution states (1948) that "the Waikato population presents a picture of continuous and aggressive expansion." The Myna was introduced mainly from Australia whither it was originally imported from India.

Adult. Top of head and hind neck greenish black; upper surface vinous brown with an ashy shade; primary coverts white; quills black, the secondaries externally bronzy brown; tail feathers greenish black, tipped with white. Throat and foreneck greenish black; breast and sides of body vinous brown, shaded with ashy; abdomen and under tail coverts white. Bill, eyelids and bare skin on face yellow. Iris reddish brown. Feet yellow. Bill 20, wing 140, tail 87, tarsus 35, mid toe 33 mm.

Eggs. Clutch four or five, elliptical, greenish blue, 30 x 21.5 mm.

Distribution. North Island, on the west side mainly from Auckland and Tauranga in the north to New Plymouth and Wanganui in the south; on the east side from East Cape to Dannevirke. Small isolated groups in the Wellington Province.

Afghanistan, India, Ceylon, Burma, Tenasserim. Introduced to Mascarene Islands, Australia and many Pacific Islands.

Habits. The food of the Myna consists mainly of insects but includes also fruit and seeds. The Myna builds an untidy nest of straw and feathers or other handy materials in buildings or in holes in trees, and generally rears two broods in a season.

Ecology. The main problem concerning the Myna is the cause of its disappearance from many localities and of its general movement northwards. Thomson, quoted above, thought that the presence of starlings was a factor in its disappearance. There is, however, some evidence to show that Mynas, bird for bird, can oust starlings as they do sparrows, but, as I indicated under the Starling, starlings increase in numbers much more rapidly than Mynas and by weight of numbers can drive the Mynas away. Mynas, according to Cunningham, are increasing fast in the Auckland Province. I judge, therefore, that the real cause underlying the general northward movement of Mynas is that they thrive best in a warm climate. The Myna prefers the society of man but Cunningham points out that as their numbers increase they spread out into the rural areas and thus their distribution becomes more regular. The Myna ranks with the Starling in usefulness as it is mainly an insectivorous feeder. It is to be seen perched on cattle, horses, sheep and pigs searching for parasitic insects. In Taranaki it was at one time stated that it had practically wiped out caterpillars. On the other hand Mynas are blamed for attacking fruit and grain and becoming a nuisance by eating food in fowl runs. "They are particularly numerous in the vicinity of pig farms," writes Cunningham, "where they relish skim milk."

References.—Linne, Syst. Nat., 12th ed., 167, 1766 (*Paridisea tristis*). Thomson, Nat. Anim. Pl. N.Z., 159, 1922; Wild Life N.Z., pt. II, 49, 1926. Cunningham, N.Z. Bird Notes, 3, 57, 1948; Notornis, 4, 66, 1951.

FAMILY CORVIDAE

Rook

Corvus frugilegus frugilegus

According to the records collected by G. M. Thomson, Rooks were imported into New Zealand by different societies and on various dates between 1862 and 1875, the first birds being liberated at Nelson. These early imported birds seemed to have survived only in Canterbury and Hawke's Bay.

Adult. Forehead, lores, fore part of cheeks and throat bare, greyish white. General colour glossy purplish black, duller below, the head and neck rich purple with a greenish tinge on sides of face. Bill and feet black. Iris dark brown. Bill 56, wing 315, tail 190, tarsus 55, mid toe 48 mm. In the young the face is fully feathered.

Eggs. Clutch three to five, ovoid, pale green, marked fairly closely all over with dark and light brown blotches and spots. 33 x 26, 34.8 x 26.4, 35.5 x 26.5 mm.

Distribution. Nesting colonies at Puketapu (no recent records) and Hastings in Hawke's Bay; at Pirinoa and Hinakura east of Lake Wairarapa; and at Sunnyside and Hornby near Christchurch. Feilding, across the Ruahine Range from Hawke's Bay, is frequently visited by Rooks.

Europe. Other subspecies in Asia.

Habits. The food of the Rook consists mainly of insects and worms, but young birds and their eggs are eaten and also grain, fruits, and vegetables when available. "When the young can fly," writes E. F. Stead, "they accompany their parents on bird-nesting expeditions, the victims being mostly sparrows, whose nests they tear to pieces, devouring the eggs or young to the accompaniment of the most ecstatic cawing." Rooks dig in the ground in their search for insects and will pull up grass or other plants in the process.

The Rook nests in colonies of considerable size. It builds its large untidy nests in the top branches of gum and pine trees. In the latter case the nests cannot always be seen from the ground. The nesting material is sticks and mud with grass for a lining. The nests are reconstructed year after year and in time become quite bulky.

Ecology. Rooks prefer open country, firstly because they feed mainly on arable land, secondly because they prefer for nesting places plantations of trees surrounded by open spaces, and thirdly because they like to be able to have a clear view when feeding in case anything they think might be dangerous approaches. They are not at all attracted to our forests. They are not usually disturbed by other birds though when they have appeared in a new locality in small numbers they have been chased away by Australian magpies. The Rook must be accounted a useful bird so far as it eats grubs from pastures, but if the pasture happens to be a golf course then the Rook is not welcome as it damages the sward in rooting out the grubs. Its depredations on sparrows and skylarks can be counted to its credit. The damage it does to certain crops is, however, often serious. It pulls out sprouting oats, maize and pumpkins in order to eat the seed, and as it works systematically over a field considerable areas can be completely ruined in a day. It also digs up potatoes and it picks walnuts taking them a little distance for eating.

References.—Linne, Syst. Nat., 10th ed., 105, 1758 (*Corvus frugilegus,* Sweden). Thomson, Nat. Anim. Pl. N.Z., 152, 1922; Wild Life N.Z., pt. II, 42, 1926.

FAMILY STREPERIDAE

White-backed Magpie

Gymnorhina hypoleuca

The Australian White-backed Magpie, which is the species now most commonly seen in New Zealand, was imported and liberated in large numbers from Auckland to Otago between 1864 and 1874. According to Thomson it disappeared from Otago but now it is gradually spreading southward from Canterbury.

Adult Male. Head, scapulars, quills, terminal half of tail, and under surface (except under tail coverts) glossy black. Hind neck, back, wing coverts, upper and under tail coverts and basal half of tail white. Bill bluish horn colour, tip black. Iris yellowish brown. Feet black. Bill 53, wing 295, tail 156, tarsus 60, mid toe 46 mm. *Adult Female.* Similar to male but greyish instead of white above; the black has a more brownish tinge. *Colour Variety.* An albino has been recorded from Waipawa. (Mrs. H. Gill).

Eggs. Clutch two or three, occasionally four or five, ovoid, pale green marked closely all over with brown and greyish blotches. 37.5 x 27, 38.6 x 26.8, 41.4 x 29.6 mm.

Distribution. Hokianga district to Hunua Hills. From Taranaki, Lake Taupo and the Waiapu River south to Cook Strait. Eastern side of the South Island from Kaikoura to Otago Peninsula. A few occurrences outside these limits. Little Barrier and Kapiti Islands, occasional. Ascending to 4,000 feet on Mount Ruapehu.

Central and South Australia, Victoria, Tasmania (several subspecies).

Habits. The food of the White-backed Magpie consists mainly of insects which are obtained usually by probing the ground in pastures. The principal kinds are grass grubs, grasshoppers, crickets and maggots of flies. Worms, snails, small birds and their eggs and mice are also eaten while fat and meat are picked from sheep and rabbit skins hung out to dry.

The Magpie nests in trees, commonly placing the nest in a conspicuous position. The nest is a large loose structure, one to two feet in diameter, of sticks lined with grass. The breeding season is mainly from August to November, but some nests are built in June or July. One or occasionally two broods are reared in a season. The incubation period, according to the dates published by McCaskill, is 21 to 24 days. Magpies do not tolerate an intruder near their nest. They attack by swooping at the supposed danger, often so close as to knock off a hat or even do some personal injury. It is not at all pleasant or even safe to attempt to climb a tree to one of their nests.

The flute-like notes forming a kind of irregular carol are pleasing to hear. Most of the singing is done in the mornings and evenings.

Ecology. In New Zealand the White-backed Magpie frequents open settled districts, generally feeding on the ground in pastures and on ploughed land. It consumes large numbers of grass grubs and other harmful insects and is thus beneficial to farmers. It makes a likeable pet, soon becoming tame and sociable and is usually a safe bird for a garden. It may, however, playfully pull up seedlings and pick flowers.

Against these good qualities is a long list of undesirable ones. Magpies are aggressive birds and can chase away all other kinds except rooks. If a harrier appears it immediately attacks and puts it to flight and may even kill it. So far as it keeps harriers from attacking chickens the Magpie has been said to be beneficial. Even keas are said to avoid magpies while tuis and most other birds keep out of their way. The Magpie feeds its own young on nestlings which it takes from the nests of other birds. It also kills such birds as come in its way, and as it is a very fast flier small birds have little chance of escaping. The following native species have been recorded as being killed by Magpies—harrier, pigeon, tui, bellbird, pipit, silvereye, fantail and grey warbler. Introduced species are also victims of its vicious attacks. Pheasants, pigeons, thrushes, blackbirds, skylarks, sparrows, yellowhammers and fowls are among the birds that have been killed by Magpies. More serious is its habit of picking out the eyes of cast sheep, lambs and even a horse. In the breeding season it will attack both adults and children by swooping at them. In this way it has injured men, children and a baby. Magpies occasionally cause trouble by short-circuiting power wires. Many of them are killed in this way. Sometimes a little damage is done to gardens or lawns by Magpies disturbing the ground in order to get worms and insects. For this reason and also for its destruction of birds it seems evident that the beneficial work performed by the Magpie would better be done by other kinds of birds.

References.—Gould, Syn. Birds Austr., 4, 1837 (*Cracticus hypoleucus,* Tasmania). Thomson, Nat. Anim. Pl. N.Z., 151, 1922; Wild Life N.Z., pt. II, 39, 1926. Mathews, Birds Austr,, 19, 350, col. pl. 1923. McCaskill, N.Z. Bird Notes, 1, 86, 1945. Westerskov, Notornis, 5, 243, 1954.

Black-backed Magpie

Gymnorhina tibicen

I can find no record concerning the time or place of liberating the Black-backed Magpie in New Zealand. Probably this species was imported among White-backed Magpies.

Adult Male. Glossy blue-black; the hind neck, rump, upper and under wing coverts, edge of wing, upper and under tail coverts, and basal portion of tail white. Bill 55, wing 270, tail 170, tarsus 60, mid toe 42 mm. *Adult Female*. Colour pattern as in male but grey instead of white above, and the black has a more brownish tinge.

Black-backed Magpies mated with White-backed Magpies have been recorded on two occasions in New Zealand, once at Kaikoura (McCaskill), and once at Waipukurau (Cunningham). There is a similar record for Banyena, Victoria (Favaloro).

Eggs. Clutch two to five, greenish white to bluish grey, streaked and spotted with brownish red to purplish black and dull slate. 39 x 26, 41 x 29, 43 x 29 mm.

Distribution. Karaka near Auckland. Wangaehu-Turakina district, Hunterville, Raumati. Clive and Hastings to Waipukurau, Dannevirke to Woodville, Pahiatua, Wairarapa. Waiau (Marlborough). Cheviot-Kaikoura district. Nowhere common.

Australia except the north and south of Western Australia.

References.—Latham, Ind. Orn. Suppl., 27, 1801 (*Coracias tibicen*, N.S.W.). Mathews, Birds Austr., 10, 337, col pl.. 1923.

FAMILY PLOCEIDAE

House Sparrow

Passer domesticus domesticus

The history of the introduction of the House Sparrow into New Zealand was carefully investigated by G. M. Thomson, who found that nearly all the acclimatisation societies took a hand, and congratulated themselves on the success of their efforts. After the species was firmly established, however, and it was evident that the Sparrow was going to be a nuisance, individuals and societies alike repudiated responsibility for the introduction. The actual facts, according to Thomson, are: The Nelson Society, in its shipment of 1862, landed a single sparrow; in 1865, two sparrows, the survivors of a shipment of six dozen, were landed at Auckland; in 1866, the Wanganui Society imported sparrows; in the following year both the Canterbury and Auckland societies liberated shipments, and a year later, the Otago Society imported some more. Only the Wellington Society appears not to have directly imported the Sparrow. About 1880 Sparrows found their own way to the Chatham Islands and later they occupied some of the Southern Islands which lie in one of the stormiest regions in the world.

Plumages. Though Sparrows appear much alike except for the noticeable differences in the sexes, the male having a black throat while in the female it is ashy, there are in reality several phases of plumage. In winter, the male sparrow is browner than it is in summer and sandy buff tips to the feathers are conspicuous and obscure the black of the throat. The summer plumage is regained by shedding the pale tips of the feathers while the bill becomes darker. The female is in general browner than the male while young birds of both sexes at first resemble the adult female. At the first autumn moult the male assumes the adult winter plumage, the black throat being distinguishable below the ashy edges to the feathers. *Colour Varieties*. Albinos and partial albinos have been observed in New Zealand. Partial albinos have been seen in a colony containing an albino male mated to a normal female. Buff-coloured sparrows have been reported from Dunedin and Bulls.

Eggs. Clutch five to seven, ovoid, very variable in colour and spotting, but generally light grey spotted and streaked with brown, 22.5 x 15.7 mm. (av.).

Distribution. North and South Islands. Three Kings, Mokohinau, Little Barrier, Great Barrier, Poor Knights, Mayor, Karewa, Kapiti, Codfish, Stewart, Chatham, Snares, Auckland Islands.

Europe, except Italy, eastward to Siberia. Other subspecies in Italy, North Africa and parts of Asia.

Habits. Though the food of the nestling Sparrow for the first week of its existence is almost entirely insects, the adult is decidedly omnivorous. Insects form a large share of its food in certain localities and at certain seasons, but at other times, grain is the principal food taken. Flower buds, leaf buds, young fruits, ripe fleshy fruits, particularly cherries, grapes and peaches form a portion of its food. Sparrows have been observed sipping the nectar from the flowers of the pohutukawa and the New Zealand flax (*Phormium*). They frequent beaches and intertidal mud flats in search of food. Almost any situation is utilised by the Sparrow for its nest—houses, trees, holes in cliffs. The nest is large, covered, and made of grass with a small opening on one side leading to the feather-lined interior. Several broods are reared in a season which lasts from July to April. According to the observations of T. W. Kirk, the broods succeed one another so quickly that all but the first-laid eggs are partly incubated by the succession of young sparrows. The incubation period is about thirteen days and the young are fed for eight or nine days.

Ecology. The Sparrow is now exceedingly abundant throughout the country. It prefers the company of human beings, being found wherever there is a habitation, but it is encountered in many distant parts and offlying islands though it does not penetrate far into the forest. Much has been written on the qualities of the Sparrow in its relation to man. In its favour it will suffice to say here that it destroys large quantities of insects including many that are injurious to orchards, pastures and gardens. The nestlings are fed almost entirely on insects. The Sparrow helped materially to rid the north of Auckland of cattle ticks. The harmful qualities, however, more than outweigh the beneficial ones. On account of its enormous numbers, impertinent familiarity with man and omnivorous habits, the Sparrow has become a serious pest to the agriculturist. It devours immense quantities of grain just before the harvesting, destroys buds, young fruit and flowers, pulls up seedlings to feed on the germinating seed and takes the grain fed to poultry. Through its habit of building its numerous nests in all available situations it causes much annoyance and sometimes damage by placing its nests in gutters, rainwater pipes and chimneys. It has been known to pull the insulation off power lines. Further it occupies the nesting sites of other species of birds which might be useful insect eaters.

References.—Linne, Syst. Nat., 10th ed., 183, 1758 (*Fringilla domestica,* Sweden). Buller, Birds N.Z., 2nd ed., xliv, 1888. Kirk, Trans. N.Z. Inst., 32, 109, 1891. Drummond, Trans. N.Z. Inst., 39, 320, 1907. Thomson, Nat. Anim. Pl. N.Z., 164, 1922; Wild Life N.Z., pt. II, 52, 1926.

FAMILY FRINGILLIDAE

Greenfinch

Chloris chloris

The Greenfinch was introduced to Nelson, 1862; Christchurch, 1863; Auckland, 1865; Otago, 1868. Drummond states that the first pair introduced to Christchurch reared six young in two broods the first year. Next year, twenty were seen and they soon became well established.

Adult. Upper surface olive green, the feathers edged with grey; forehead, eyebrow and sides of face yellow; ear coverts brownish grey tinged with green; lores blackish brown; lower back yellowish green; upper tail coverts dark grey tinged with green; median and lesser wing coverts brownish green; greater wing coverts greyish brown tinged with green; primaries brownish black tipped with grey and edged on the outer webs with greenish yellow; secondaries brownish black edged with greenish; tail feathers brownish black edged with grey, the four outer pairs with basal half greenish yellow. Throat and breast yellowish green; upper abdomen greenish yellow; lower abdomen and under tail coverts greyish white. Bill 14, wing 85, tail 57, tarsus 18, mid toe 18 mm. The male in winter, female, and young are browner. *Colour Variety.* There is a white Greenfinch with the yellow unaltered in the Taranaki Museum.

Eggs. Clutch four to six, commonly pale bluish with scattered spots and blotches of dark and light brown mostly at the larger end; ground colour sometimes white or greenish. 21.5 x 14.8, 22.8 x 13.8 mm.

Distribution. North and South Islands. Little Barrier, Kapiti, Stewart, Chatham, Auckland and Campbell Islands.

Europe, North Africa, South-west Asia to Persia and Turkistan.

Habits. The Greenfinch frequents the settled districts, coming right into the towns and is, in some localities, though not conspicuous, fairly common. It enters the forest only for a short distance but pine plantations are favourite resorts as there it feeds on the pine seeds and builds its nests in the trees. It is most frequently noticed after the breeding season when it congregates in small flocks. Its food consists of seeds, including grain, and it has a predilection for seeds of pine trees and milkweed; fruits, especially the fleshy kinds; green leaves, flowers and young fruit; the larvae of insects with which the young are fed.

The Greenfinch is reported to be most destructive to cereal crops and also to orchards, as it not only eats grain and ripe fruit but also attacks fruit-tree flowers. During the greater part of the year, however, it will be doing good work destroying insects.

Nesting. The nest of the Greenfinch is placed in the fork of a shrub or tree. It is built of fine sticks, rootlets, grass, moss and wool, and lined with thistledown, feathers, wool and hair. The breeding season is mostly from September to January and usually two broods are raised during the season. The incubation period is given by Jourdain for English greenfinches as 13-14 days, but there is a New Zealand record by L. Gurr of three young being hatched on January 25th in a nest in which the last three of four eggs were laid on the 13th, 14th and 15th. The bird was observed sitting closely on the 15th so that the period of incubation was approximately eleven days.

References.—Linne, Syst. Nat., 10th ed., 174, 1758 (*Loxia chloris,* Europe). Thomson, Nat. Anim. Pl. N.Z, 174, 1922; Wild Life N.Z., pt. II, 66, 1926.

Chaffinch

Fringilla coelebs gengleri

The Chaffinch was introduced as early as 1862 and liberated near Nelson. Subsequently it was released in many parts of New Zealand by acclimatisation societies and private individuals. It quickly established itself and is now found in all parts of the country, ascending to the upper limits of the forest. Guthrie-Smith traces the probable route of the Chaffinch from Auckland, where it was released, to Hawke's Bay. He thinks it mainly followed the coast but went inland up the Motu Valley to cross the mountains.

Adult Male. Forehead black; top of head and hind neck slaty blue; upper back and scapulars chestnut-brown; lower back and rump olive-green; lesser and median wing coverts white; greater wing coverts black, tipped with white; quills black, margined with olive-yellow; upper tail coverts and two middle tail feathers ashy grey, rest of tail feathers black with white bands on two outer pairs. Side of face and under surface vinous red, paler on lower breast and sides; abdomen and under tail coverts white. Bill lead-blue. Feet brown. Bill 10, wing 88, tail 63, tarsus 17, mid toe 17 mm. In winter the feathers of the head and under surface have sandy buff edges obscuring the grey of the head and neck. The *adult female* has a similar pattern of coloration but is duller; the crown, hindneck and back are ashy brown, washed with olive yellow; the under surface is pale ashy brown, lighter on the throat, and tinged with pink on throat and breast. In winter the plumage is much browner. The young resembles the adult female but is more dingy; rump and upper tail coverts olive brown.

Eggs. Clutch four to six, ovoid, greyish blue, with reddish blotches, some with dark brown spots and marks within them, the blotches mostly near the larger end. There are variations in shape, size and ground colour, which ranges from pale blue to pink. 19 x 14.4, 20.2 x 14.5, 21.4 x 14 mm.

Distribution. Three Kings Islands. North and South Islands. Mokohinau, Little Barrier, Mayor, Kapiti, Codfish, Stewart, Snares, Auckland and Campbell Islands.

Habits. The Chaffinch is found in all stations from sea level to above the upper forest line and is fairly common throughout. It enters the forest and is common in plantations of exotic trees. It has been observed at an altitude of 4,000 feet on Mount Egmont and on the Salisbury Tableland in Nelson. It feeds on insects, fruit and seeds, including *Phormium,* the young being fed almost exclusively on caterpillars. The song is short but pleasant. That usually heard in New Zealand is a bar of seven notes and a terminal flourish. It is described by Andersen as "a chromatic drop of varied interval followed by a pause and a final flourish of varied vocalization." The full song is heard from June or July to January. Part songs are given before and after these months. The Chaffinch must for the greater portion of the year be accounted a useful bird as it feeds on insects and seeds of weeds. Aphides and the caterpillars of white butterflies are sought out by this bird. In the summer, however, it takes a certain amount of grain.

Nesting. The nest of the Chaffinch is a very neat structure made of slender sticks, grass, rootlets and wool, and covered with moss and foliaceous lichens, the lining being thistledown, feathers and hair. It is placed in a shrub or tree from two to twenty feet above the ground. On Little Barrier Island Sibson discovered a nest on the leaf of a nikau palm. A nest which I found in the Eglinton Valley was in a coprosma shrub about thirty inches above the ground. It was made of grass and moss completely covered with growing weymouthia moss and was lined with feathers. After the breeding season the Chaffinch gathers together in large flocks sometimes comprising up to 600 birds.

References.—Linne, Syst. Nat., 10th ed., 179, 1758 (*Fringilla coelebs,* Sweden). Kleinschmidt, Falco, 5, 13, 1909 (*F. c. gengleri,* England). Thomson, Nat. Anim. Pl. N.Z., 170, 1922; Wild Life N.Z., pt. II, 54, 1926.

Lesser Redpoll

Carduelis flammea cabaret

The Lesser Redpoll was one of the species included in a shipment of various kinds of birds imported to Nelson in 1862. It was subsequently released in other parts of New Zealand and became established throughout the country.

Adult Male. Forehead blackish; top of head dark crimson; upper surface light brown, streaked with blackish centres to the feathers, the hind neck and sides of neck paler; rump reddish, streaked with blackish brown; median and greater wing coverts blackish, edged with light brown and tipped with sandy buff; quills blackish, edged with ashy brown; upper tail coverts and tail feathers brown, edged with paler, the tail feathers white on their inner webs. Lores dusky; sides of face light brown; throat black; foreneck and breast rosy pink; abdomen white, suffused with pink; sides of body creamy buff, streaked with blackish brown. Bill 8-9, wing 66-72, tail 50, tarsus 14, mid toe 11 mm. The female differs from the male in the absence of red on the breast and rump. The young resembles the female but has no crimson on the crown, less black on the chin and more dark streaks on the throat and breast.

Eggs. Clutch four to six, bluish-green, spotted and blotched with pale purply brown with a few spots and streaks of dark reddish brown often forming a zone. 14.5 x 11.6, 15.2 x 11.6 mm.

Distribution. Three Kings Islands. North and South Islands. Kapiti, Stewart, Chatham, Snares, Auckland, Campbell and Macquarie Islands (straggler).

Europe. Other subspecies in Europe, northern Asia, Greenland, Canada. In non-breeding season to south Europe, mid-Asia and United States.

Habits. The Redpoll, states Secker, appears to be most common where the original liberations were made, but it has spread far and wide in Otago, large flocks having been seen near Lake Wakatipu. It frequents country districts and coastal sandhills rather than the towns and has been observed on mountains above the forest line. It has been encountered at 4,000 feet on Mount Egmont and, according to Stidolph, breeds in subalpine scrub on the Tararua Range. It is frequent in the plantations of exotic pines in the North Island. It feeds on small seeds, including those of weeds and various indigenous grasses and sedges; on buds of trees and other soft parts of plants; and on insects. The nest is a small compact structure made of grass, twigs and wool lined with hair, feathers or wool. It is usually built in shrubs up to ten feet or so from the ground. The eggs are laid from September to January. After the breeding season the Redpoll flocks, as many as 250 having been seen together.

The Redpoll is a useful bird in that it attacks turnip green fly and similar insects. It is reported to be harmful by eating grass seed sown in forest clearings.

References.—Linne, Syst. Nat., ed. 10, 182, 1758 (*Fringilla flammea,* Sweden). P. L. S Muller, Nat. Suppl., 165, 1776 (*Fringilla cabaret,* France). Thomson, Nat. Anim. Pl. N.Z., 172, 1922; Wild Life N.Z., pt. II, 57, 1926. Secker, Notornis, 4, 63, 1951. Westerskov, Notornis, 5, 189, 1953.

Goldfinch

Carduelis carduelis britannica

The Nelson Acclimatisation Society seems to have been first in the field with a number of kinds of birds that have been introduced into New Zealand, for, according to Thomson, besides the species mentioned elsewhere, the Goldfinch was first imported to Nelson, ten birds having been liberated in 1862. During the following twenty years, the species was liberated in several other places and soon became established at a number of points. It found its own way to the Kermadec, Chatham, Auckland and Campbell Islands.

Adult. Forehead crimson; lores black; white patch from side of crown to lower throat; top of head black, descending on each side in a broad line behind the ear coverts; nape whitish; rest of upper surface pale chocolate-brown lighter on the rump; median and lesser wing coverts black with small tawny brown tips; greater coverts golden yellow, the outer ones black on outer webs at base, inner ones brown tipped with fulvous; primary coverts black; quills black, tipped with white, primaries except outer one golden yellow for basal half on outer web, secondaries with golden yellow on outer webs at base; upper tail coverts white, shaded with fulvous; tail feathers black, tipped with white, outer two on each side with white patch on inner webs. Throat crimson; upper breast pale fulvous brown; rest of under surface white, the under tail coverts shaded with fulvous. Bill pinkish white at base, black at tip. Feet pinkish white. Bill 12, wing 75, tail 45, tarsus 15, mid toe 15 mm. Female similar to male but wing coverts browner. *Immature.* Upper surface brown with blackish tips to feathers; wings as in adult except that median and lesser wing coverts tipped with fulvous brown, greater coverts with buff outer webs and tips; under surface white, washed with brown on foreneck and breast which are spotted with blackish. *Colour Variety.* Stidolph describes a bird from Masterton as white except for yellow on the primaries and black ends to the quills and tail feathers.

Eggs. Clutch five or six, ovoid, pale blue with sparse reddish-brown blotches all over and forming zone at larger end, 17 x 12 mm. (av.).

Distribution. North and South Islands. Kermadec, Three Kings, Mokohinau, Little Barrier, Kapiti, Stewart, Chatham, Snares, Auckland, Campbell and Antipodes Islands.

British Isles. Other subspecies in Europe, western Asia and north-west Africa.

Habits. The Goldfinch is abundant throughout the Dominion, chiefly in the settled districts, though it penetrates far into the mountainous regions, has been observed in several of the sounds of west Southland and has spread of its own accord to the distant outlying islands. It was observed at an altitude of 4,000 feet on the Salisbury Tableland. Its food consists mainly of seeds, especially those of composites, but in winter it may be forced to eat grass leaves and what it can pick up on the beaches. Notwithstanding its gorgeous colouring, when feeding on the large thistles it so harmonises with its surroundings as to make it difficult to detect. The nest of the Goldfinch is a neat structure of grass, rootlets, cobwebs, hair, wool and flower heads lined with thistledown, wool, hair or feathers. After the nesting season Goldfinches congregate in large flocks, as many as 500 and in one case 1,000 being reported in one flock.

In destroying seeds of thistles, dandelions and other weeds, the Goldfinch does a considerable amount of good. It occasionally eats grain and has been reported to eat the seeds out of strawberries. Mrs. Tily reports that an entire crop of rape seed covering between ten and fifteen acres was taken by Goldfinches.

References.—Linne, Syst. Nat., 10th ed., 180, 1758 (*Fringilla carduelis,* Sweden). Hartert, Vog. Pal. Fauna, 1, 68, 1903 (*Acanthis c. britannicus,* England). Thomson, Nat. Anim. Pl. N.Z., 173, 1922; Wild Life N.Z., pt. II, 62, 1926.

Yellow Hammer

Emberiza citrinella citrinella

The Yellow Hammer was included in the importation made by the Nelson Acclimatisation Society in 1862. It was subsequently liberated in Auckland, Canterbury and Otago and quickly became established throughout the country.

Adult Male. Head and neck yellow with streaks of greenish black across forehead and on top and sides of head; upper surface brown with black centres and ashy margins to the feathers; lower back, rump and upper tail coverts vinous chestnut, the lower back streaked with blackish; wing coverts black, broadly edged with rufous brown; quills dark brown, narrowly edged with ashy olive; tail feathers dark brown edged with fulvous, somewhat rufescent on the central ones, the two outer feathers white on inner webs. Upper breast greenish olive; lower breast and sides pale chestnut, the flanks streaked with black; abdomen and under tail coverts yellow. Bill 11, wing 92, tail 75, tarsus 18, mid toe 21 mm. In winter the feathers are more broadly edged with ashy and the lower breast is yellow. *Adult Female.* Similar to male but less yellow on head; crown ashy olive, streaked with black; under surface pale yellowish with black spots on sides of face and streaks on throat and foreneck, and rufous brown streaks on the flanks. *Immature.* Similar to adult female but more yellow below and more distinctly streaked both above and below.

Eggs. Clutch three to five, pinkish cream, marked all over with light brown and grey blotches and lines with a few dark brown lines. 21 x 17.2, 20.5 x 15.2, 21.5 x 16 mm.

Distribution. Raoul Island. North and South Islands. Three Kings Islands, Mokohinau, Little Barrier, Kapiti, Chatham, Codfish, Stewart, Auckland and Campbell Islands.

Europe except the east. Other subspecies in east Europe, and Palaearctic Asia.

Habits. The Yellow Hammer is found in the settled districts, coming into the towns, more especially in the winter time when it is encountered in small flocks. It is common in plantations of exotic pines in the North Island. Its food is mainly grain and other seeds, but insects also are eaten. The nest is placed on the ground or in a dense shrub a few feet, usually two or three but sometimes five, above the ground. It is roughly constructed of grass and small sticks and lined with finer grass and hair. The eggs are laid from October to January.

On account of its grain eating habits, the Yellow Hammer must be included among the most harmful of the birds introduced into New Zealand. Besides feeding largely on grain it does a considerable amount of damage by eating grass seed sown on newly-burned bush clearings. The good done by the Yellow Hammer in destroying insects is possibly outweighed by the harm caused to grain crops and hay stacks.

References.—Linne, Syst. Nat., 10th ed., 177, 1758 (*Emberiza citrinella,* Sweden). Thomson, Nat. Anim. Pl. N.Z., 176, 1922; Wild Life N.Z., pt. II, 72, 1926. Witherby *et al.,* Handbk. Br. Birds, 1, 113, 1948.

Cirl Bunting

Emberiza cirlus cirlus

The only records of the introduction of the Cirl Bunting to New Zealand given by G. M. Thomson, are seven birds liberated in Otago in 1871 and four in Wellington in 1880. Evidently both lots became established as the species is now found in several localities in both islands. In 1879, eighteen birds were transferred to Stewart Island.

Adult Male. Crown and hindneck greyish green streaked with black; a yellow superciliary streak; lores and line through eye black; upper back and lesser wing coverts chestnut streaked with black; lower back and rump olive brown streaked with dusky; greater coverts and quills dark brown edged with olive; tail feathers dark brown edged with fulvous, the two outer ones with white on inner webs. Cheeks yellow, throat black, succeeded by a yellow collar; upper breast greyish green, lower breast chestnut; remainder of under surface pale yellow becoming brown streaked with blackish on the flanks. Bill 11, wing 98, tail 62, tarsus 16 mm. The female lacks the black and yellow markings on the face but the throat is yellow, throat and breast striped, lesser wing coverts greenish grey. Young resemble female.

Eggs. Clutch four or five, greyish or pinkish white with small pale brown blotches and dark brown lines and spots mainly at the larger end. 19.8 x 16, 21.4 x 16.4 mm.

Distribution. Tauranga, Taranaki (no recent records), Hawke's Bay, Manawatu, Wairarapa, Hutt Valley, Wellington, Canterbury, Otago, Resolution Island, Stewart Island (no recent records).

Europe, Asia Minor, Transcaucasia. An-

Christchurch *K. V. Bigwood*

CIRL BUNTING

other subspecies in Corsica.

Habits. In England, the Cirl Bunting, according to Bowdler Sharpe, associates in small flocks in full breeding plumage until the beginning of the breeding season. In autumn, small parties of young and old birds may be noticed. They do not associate with other species but keep to themselves. The food consists mainly of seeds but insects are also eaten. The nest is placed on the ground or in a shrub a few feet from the ground. A nest found in New Zealand is an untidy structure of grass and rootlets lined with fine rootlets and hair.

References.—Linne, Syst. Nat., 12th ed., 311, 1766 (*Emberiza cirlus,* S. Europe). Thomson, Nat. Anim. Pl. N.Z., 175, 1922; Wild Life N.Z., pt. II, 70, 1926. Witherby *et al.,* Handbk. Br. Birds, 1, 126, 1948.

FAMILY ALCEDINIDAE

Laughing Kookaburra

Dacelo gigas

Several small shipments of the Laughing Kookaburra, or Laughing Jackass as it is often called, were liberated between 1866 and 1880, but none survived except those placed on Kawau Island by Sir George Grey. These gradually increased and eventually crossed to the mainland where they have been seen from Whangarei to Devonport.

Adult. Top of head brown, varied with rufous on the forehead, and the long crest feathers edged with white; a whitish band from over each eye joining on the nape; below this a dark brown band, followed by a broad white collar; general colour of upper surface brown; the upper back white, barred with brown; lower back and rump greenish blue; tail and coverts rufous barred with black, all the tail feathers but the central ones tipped with white; median wing coverts tipped with greenish white; quills blackish, white at the base. Lores blackish; under surface dingy white, freckled with dusky margins to the feathers. Bill 64, wing 216, tail 160, tarsus 25, mid toe 40 mm.

Eggs. Clutch four or five, rounded, oval, white, 42.4 x 32.2, 41 x 32.2 mm. North Queensland.

Distribution. North Auckland from Whangarei to the Waitakerei Ranges. Kawau Island. Stragglers, possibly from Australia, have been seen at Cape Maria van Diemen (after a north-west gale) and Barrytown (Westland).

Queensland to Victoria and South Australia. Introduced to Western Australia and Tasmania.

Habits. The Kookaburra in its native country feeds on lizards, snakes, small mammals and birds, and large insects. Snakes are seized behind the head, taken to a perch on a tree and battered until they are dead, or they are dropped several times from a height to the ground. The Kookaburra is perhaps most famed for its laugh which is heard at sunrise and sundown. It is a wild chorus given from the tops of trees where the birds congregate for the night. The nest is placed in a hollow tree or in a white ants' nest in a tree. The Kookaburra is valued in Australia on account of it feeding on snakes and other noxious animals. Unfortunately, it sometimes kills native birds and it has been reported to have taken chickens and ducklings from farmyards.

References.—Boddaert, Tabl. Pl. Enlum., 40, 1783 (*Alcedo gigas,* Queensland). Mathews, Birds Austr., 7, 118, col. pl. 1918.

FAMILY PSITTACIDAE

White Cockatoo

Cacatua galerita

The White Cockatoo is a favourite cage bird which for many years has been imported from Australia. Since about 1920 escaped birds have established themselves in several North Island localities.

Adult. White; crest deep sulphur-yellow; under wing coverts and under tail coverts tinged with yellow. Bill black, Iris brown. Feet blackish. Bill 49, wing 370, tail 250, tarsus 26, mid toe 60 mm.

Eggs. Clutch two-four, lengthened oval, glossy, white. 47 x 30, 47.5 x 31 mm.

Distribution. Colonies established at Wellsford, Hunua Hills, Glen Murray, Fordell and Turakina Valley, and Hunterville. Reported seen at Onewhero (Waikato) and Wainuiomata.

Australia, Tasmania, Moluccas, New Guinea (several subspecies).

Habits. The White Cockatoo inhabits the forest in those districts where it has established itself. The birds are said to be particularly wary and will allow no one to come within gunshot. When feeding on the ground they always post a sentinel who warns the flock of any danger. In their wild state they feed mainly on bulbous roots and seeds.

In Australia the breeding season extends from August to November and the nest is usually placed in a hole in a tall tree or in a cliff. The cry of the White Cockatoo is a harsh discordant screech.

In agricultural districts in Australia the White Cockatoo does a great deal of damage to grain, pumpkins and other crops. In New Zealand it is reported to have damaged haystacks by pulling them to pieces to get the grain.

References.—Latham, Ind. Orn., 1, 709, 1790 (*Psittacus galeritus,* N.S.W.). Mathews, Birds Austr., 6, 170, col. pl. 1917.

Rosella

Platycercus eximius

Like the White Cockatoo this parrakeet is imported into New Zealand as a cage bird and it has escaped in the Auckland district and become naturalised. About 1910 a small shipment of Eastern Rosellas, including a few Crimson Rosellas, that had been refused entry into New Zealand by the Customs Department, was released off Otago Heads by the ship which brought them as she was returning to Sydney. The two species crossed and now no pure birds of the crimson rosella remain in the Dunedin area.

Adult. Top and sides of head scarlet; hind neck yellow spotted with black; back black with wide greenish yellow margins to the feathers; wings blue with black centres to the coverts and greenish yellow margins to the secondaries, inner webs of primaries brown; rump and upper tail coverts pale green tinged with yellow; two central tail feathers bluish green, remainder blue. Throat white; breast scarlet; upper abdomen yellow; lower abdomen pale green; under tail coverts scarlet; lower surface of tail pale blue. Bill horn colour. Iris brown. Feet blackish brown. Bill 20, wing 160, tail 190, tarsus 20, mid toe 27 mm.

Eggs. Clutch six to nine, broadly oval, white, 27 x 22, 26 x 21 mm. Tasmania.

Distribution. North Auckland from Waitakerei Range to near Whangarei. Moumoukai Valley, south of Auckland. Dunedin and vicinity; also Maungatua, Waipori Gorge, Mount Allen (Central Otago), and Waitati.

South Queensland, New South Wales, Victoria, south-east of South Australia, Tasmania.

Habits. In New Zealand the Rosella is found mostly in or near forest. It has been seen breaking up kauri cones and eating the seeds. It is reported feeding on flowers of daisies and willow trees, gooseberries, raspberries, haws, dock seed and grain, and to have damaged fruit trees.

In Australia the Rosella commits a considerable amount of damage to grain and fruit. In Tasmania it resorts to the lightly timbered and open tracts of country where it may be seen in large flocks. Its nest is placed within the trunk of a tree or in the end of a hollow limb.

References.—Shaw, Nat. Mis., 3, 93, 1792 (*Psittacus eximinus,* N.S.W.). Mathews, Birds Austr., 6, 352, col. pl. 1917.

ADDENDA

Information regarding the following two species of birds was received after the preceding part of the book was in page form. The Gull-billed Tern is a visitor that was observed in the vicinity of Invercargill on three occasions this year while the Bulbul is an introduced Passeriform that has bred in the suburbs of Auckland.

FAMILY STERNIDAE

Genus Gelochelidon

Bill short, high, stout, longer than tarsus. Wings more than twice length of tail. Fork of tail shorter than half tail. Tarsus longer than middle toe and claw. Webs of toes incised.

Differs from Sterna in the short bill and short tail. In these same characters it resembles Hydroprogne but differs from that genus in the tarsus being proportionately longer in relation to the bill and the tail proportionately longer in relation to the wing.

Gelochelidon contains a single species of several subspecies almost cosmopolitan in distribution but not found in the Pacific Islands.

Reference.—Brehm, Vog. Deut., 771, 1831 (*Gelochelidon*, type *G. meridionalis* Br. = *Sterna nilotica* Gmel.).

Gull-billed Tern

Gelochelidon nilotica

Two Gull-billed Terns were seen at the Invercargill aerodrome associating with godwits and gulls by a party consisting of Mr. and Mrs. H. R. McKenzie, Mrs. Olga Sansom and Mr. B. A. Ellis on May 26th, 1955. The birds were again seen, by Mr. Ellis, the following July 22nd.

Adult. Crown black from bill to nape including the eye; feathers of nape white with black tips. Back, wings and scapulars pale grey; primaries grey, white on inner webs, dark brown on outer webs of outer quills. Upper tail coverts, tail and under surface white. Bill black, iris dark hazel, feet black, soles with an orange tinge. Bill 45, wing 432, tail 140, tarsus 36 mm. In winter the crown and nape are white streaked with black; ear coverts and feathers surrounding eye black. *Immature.* "Like adult winter except for retained brown-tipped juvenile tail feathers, blacker and worn primaries and dark tipped primary coverts." (Witherby.) *Juvenal.* Crown and nape white striped with black. Upper surface pale grey, feathers of upper back, scapulars and inner secondaries with dark centres and broad pinkish-buff edges; rump feathers and wing coverts with pale tips; tail feathers with dark tips edged with white. Under surface white. *Nestling.* Brownish-grey above spotted and streaked with brownish black; crown with three narrow irregular lines; two parallel stripes on mantle and central streak down back. Under surface white.

For Queensland birds Alexander describes three stages: (1) Head white more or less spotted with black. He suggests these are first season birds. (These are the juvenals described above.) (2) Crown white but a stripe of black along each side of the head from the bill through the eye. He suggests these are second season birds. (These are the winter and immature birds described above.) (3) Adults with crown and sides of head entirely black. Alexander suggests that adult birds never lose the black crown.

Eggs. Clutch two to four, oval, buffy white to light brown or greenish grey, blotched and spotted with blackish brown, purplish red and purplish grey. 51-55 x 37-38 mm.

Status. The birds seen at Invercargill probably belong to the Australian subspecies *macrotarsa* characterised by its paler coloration and long bill, wings and legs.

Distribution. Invercargill. May to July, 1955, sight record.

The species occurs in Europe, Africa, southern Asia, Malay Archipelago, New Guinea, Australia, Tasmania and the Atlantic coast of America. The subspecies *macrotarsa* is the form found in Australia and Tasmania.

Habits. McKenzie gives the following information regarding the two birds seen at Invercargill: "Dipping down among the other birds, the two terns fed from the short-grassed field, . . . One was seen to pick up a worm and to swallow it as it lifted again. In feeding they touched the ground only with the tip of the bill. The habit in this species of commonly feeding over pasture, marsh and still water helps to separate it from the sea-feeding terns, the manner of inland feeding being somewhat similar to that of the White-winged Black Tern . . ." In Australia the Gull-billed Tern frequents mainly inland lakes and swamps but may also be seen on estuaries and the sea coast. It breeds in small colonies on small islands in lakes and swamps. The nest is a depression in the ground with or without a little grass added. Its food consists of fish, lizards, frogs, crabs, insects and worms. In England it is reported as eating eggs and young of birds and small mammals.

References.—Gmelin, Syst. Nat., 1, 606, 1789 (*Sterna nilotica*, Egypt). McKenzie, Notornis, 6, 163, 1955. Alexander, Emu, 21, 269, 1922.

FAMILY PYCNONOTIDAE

Red-vented Bulbul

Pycnonotus cafer

As the Red-vented Bulbul has been known to be present in the suburbs of Auckland since October, 1952, and bred at Stanley Bay and Remuera in December, 1954, it may be classed as an established species though efforts are being made by the Department of Agriculture to exterminate it. Its occurrence in Auckland is being closely watched by Mr. E. G. Turbott, ornithologist at the Auckland Museum, and it is he who kindly provided me with most of the information that appears below. The first record is that made by Dr. O. F. Lamb who saw a bird answering to the description of the Red-vented Bulbul in Remuera in October, 1952. Subsequently this species was reported at Stanley Bay, Takapuna, Birkenhead and Northcote, all subsurbs of Auckland. The origin of the birds now found in the suburbs of Auckland is not known but probably they were brought from some port in India and released from the importing ship. This would be a natural thing to do when the owner found out that he would not be allowed to bring them ashore.

Adult. Head glossy black; ear coverts dark chocolate brown; upper back and wings dark brown, the feather edged with pale brown; lower back brown; upper tail coverts white; tail dark brown at base darkening to blackish brown towards the tip which is white. Breast blackish brown; abdomen brown, the lower part whitish; lower tail coverts red. "Eye dark brown, bill black, feet brown black." (Turbott.) Bill 17-18, wing 95-100, tail 78-88, tarsus 23-25, mid toe 24-25 mm. New Zealand examples. *Immature.* Remuera. Head black, back brown; wing brown, the feathers margined with rufous brown; upper tail coverts grey; tail dark brown tipped pale brown. Throat and breast brownish black, abdomen greyish, under tail coverts brownish grey. "Eye brown, bill dark brown, paler rami, feet brownish grey." (Turbott.)

Eggs. Clutch three, elongate ovoid, pinkish, closely spotted and blotched all over with reddish brown and purplish brown, chiefly at the larger end. 21.2 x 15.8, 23.5 x 16, 23.6 x 15.7 mm. Stanley Bay. (Turbott.)

Distribution. Suburbs of Auckland, breeding. The species consists of several subspecies and is widely distributed from western India eastward to China. The subspecies to which the birds found in New Zealand belong has not yet been determined. They agree quite well with the description of *bengalensis*.

Habits. The Red-vented Bulbul is a common bird in India. It is found in both forest and open country and takes kindly to gardens among human habitations where it is welcomed on account of its cheerful notes and vivacious disposition. It is, however, quite pugnacious and so is valued by the Indians as a fighting bird. It nests in shrubs, palms, creepers and trees in gardens and in the countryside. The nest is cup-shaped and is made of grass and twigs lined with fine roots, leaves and lichen. Both sexes share the work of nest building, incubation and care of the young.

The nest at Stanley Bay was situated in a pine tree. It was cup-shaped, the hollow being shallow, $1\frac{1}{4}$ inches deep, and was made of fibres and twigs lined with fine fibres.

Food. Mr. Turbott found native bees, European wasps and a soft fruit, probably plum, in the stomach of one of the birds shot at Stanley Bay . Other birds were seen to eat caladium fruits and grapes. In India its food consists of insects, soft fruits and other plant food. It does a certain amount of damage to fruit, flowers and vegetables, especially peas, but its diet includes as well many injurious insects.

Reference.—Linne, Syst. Nat., ed. XII, 295, 1766 (*Turdus cafer*).

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